MODERN PLASTICS

E. F. LOUGEE, EDITOR • DR. G. M. KLINE, TECHNICAL EDITOR • C. A. BRESKIN, PUBLISHER

JUNE 1939

VOLUME 16 NUMBER 10

• GENERAL INTEREST

• TECHNICAL SECTION

• NEWS AND FEATURES

Cover Color this month TAPESTRY ROSE (Created by Textile Color Card Association)

JULY

Plastic materials combine utility and decorative art with unique properties of hygiene and permanence in the modern interior of Bakelite Ltd.'s new London offices. A corner of the General Waiting Room is shown above. Its architectural and design features will be pictured and discussed in July. Next month's Technical section will continue Dr. Gordon M. Kline's article on the Classification and Chemical Genetics of Organic Plastics and will include a report by the United States Tariff Commission on plastic materials production.

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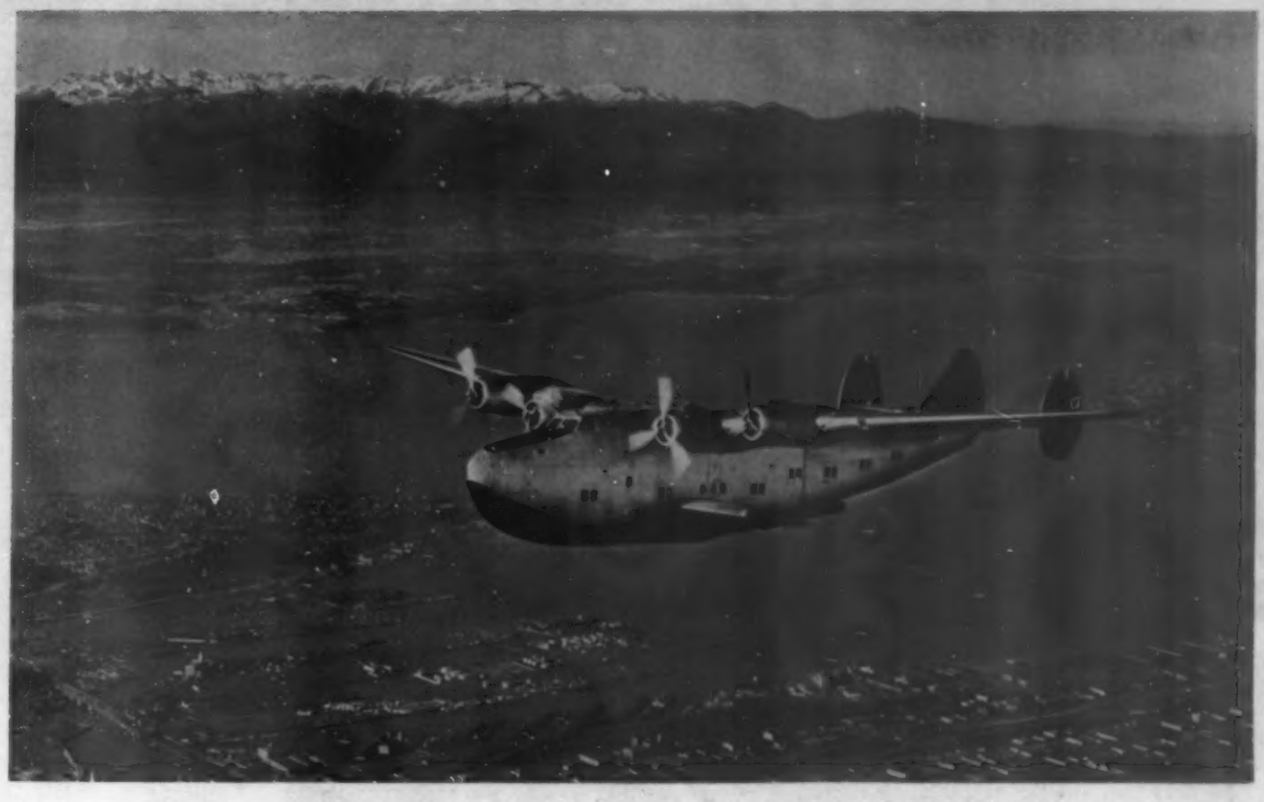

Modern in every detail of design and construction, the Yankee Clipper, christened by Mrs. Eleanor Roosevelt, is one of the largest flying ships ever built in America. Psychologically correct colors, scientifically selected, decorate the interior

YANKEE CLIPPER

by HOWARD KETCHAM*

First of a fleet of six Boeing planes to enter Pan American Airways' transatlantic service

UNDOUBTEDLY THE "OLDEST INHABITANT" can recall when it took ten days and sometimes more to cross the Atlantic Ocean. He has probably followed the launching of faster and faster ships, progressing to modern ocean liners that journey from shore to shore in five days. Now he may thrill to the knowledge that air-minded travelers can make the trip in 24 to 36 hours aboard Pan American Airways' Yankee Clipper, one of the largest airships ever constructed in America.

Safety, convenience and comfort are built into this huge ship of the air which has eighteen rooms and accommodations for 74 passengers. Four giant engines developing over 1,000 horsepower practically eliminate any possibility of danger from "engine trouble." If one, or even two engines go tempermental at the same time, flight can still be maintained on the other two, while mechanics, high in the air, inspect and adjust the trouble makers which can be reached by catwalks in the wings.

Modern in construction and detail to the "nth" degree, it is not surprising to find plastics in different forms serving in many decorative and practical applications. In a plane of such mammoth proportions, the weight of any material used must be kept as low as possible. One of the reasons why plastics were preferred to other materials, according to the chief engineer of Pan American Airways, is that they are relatively light in weight. Other considerations prompting their choice were that they are easily cleaned, need little maintenance, do not support combustion and are comparatively simple to install.

* Color and Design Consultant, Pan American Airways

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PHOTOS, COURTESY PAN AMERICAN AIRWAYS

Then, too, they can be had in colors that coincide with the designer's plan for interior harmony. Colors to live with in the air must be carefully chosen to suit all types of complexions. While it is true that most women can wear any hue providing it is the proper color variation of that hue, it is also fiendishly true that airplane cabins must be at least mildly flattering to *all* complexion types among men as well as among women. Infrequently do all types meet in the same plane at once, fortunately.

In the new clipper, psychologically correct colors go a long way toward keeping passengers happy and contented during the trip. To get a real perspective of the result of this scientific planning, let's climb into the plane for a tour of inspection.

Each of the standard passenger compartments has individual color styling to help sustain interest during the long ocean voyage and avoid any tendency to tire the eyes or to appear monotonous. Yet so harmonious and subtle are the different color treatments that no abrupt change in tempo is noticeable as one goes through from the combination Dining Room-Lounge forward, to the luxurious de luxe compartment or Bridal Suite aft in the ship. There is everywhere an air of cheeriness and brightness. A feeling of spaciousness, too, an illusion that is helped along by, for example, carrying the floor covering several inches up into the side area which seems to widen the floor space.

The Dining Room-Lounge serves a dual purpose as its name implies—a dining room seating fourteen persons at a time during meal hours, and a recreation center at other times. Table equipment is carefully planned and especially designed to combine minimum weight with maximum elegance and good taste. Table silver created in the modern manner further characterizes the simplicity and beauty of the first dining salon ever incorporated in an airplane. Fine linens, china and glassware complete the service, and gay colors animate the section.

Passenger compartments have seats upholstered in beige wool tapestry smartly tailored with leather trimming that blends with the basic theme of each interior. Some of these sections are carpeted in warm, lively Tango Rust (a color similar to terra-cotta), with beige fabric wall covering. Rich Reseda green carpeting and "Sky Line" green walls set the color note of other sections.

The atmosphere of the plane is completely transformed when the compartments are made ready for the night. Berth curtains in deep Pan American Airways blue, with blankets and berth fittings in a lighter shade of blue, induce a feeling of rest and relaxation. Comfortable mattresses, fleecy blankets promise sound sleep.

In the galley, equipped to prepare full-course hot meals for 85 persons, and in the men's and women's dressing rooms is soft, pleasant grey cork floor covering. Not only to protect the wall but for its own decorative value as well, opaque vinyl resin .015 in. thick in especially prepared colors—maroon for the men's and Pan American blue for the women's dressing rooms—is carried 40 in. up from the floor line to form a wainscot. Upper wall fabrics in the dressing rooms, galley and main entrance are safeguarded by thin sheets, (*Please turn to page 68*)

Figs. 1, 2—Translucent compartment dome lights, supplying proper diffusion of lights in Dining Room-Lounge for between-meal-time recreation as well as dining are of Tenite, which is also used for ventilator control knobs in colors to match the wall. Fig. 3—In the private compartment or Bridal Suite, adequate make-up light glows through Lumarith shades on either side of the mirror. Harmonizing with the wall fabric, decorative Micarta tops the dressing table here, the wash basins and table in the Womens' Dressing Room (Fig. 4), the walls of which have a wainscoting of Vinylite in Pan American blue. Upper wall fabric is protected by thin sheets of transparent Plexiglas. This plastic also forms the cabin windows and navigator's turret. Faucet handles, knobs and dressing table drawer pulls are of appropriately colored Catalin. Other plastics used include Lamacoid signs of passenger signal flashing lights, Pyralin gasoline tank stick gages and Catalin control knobs

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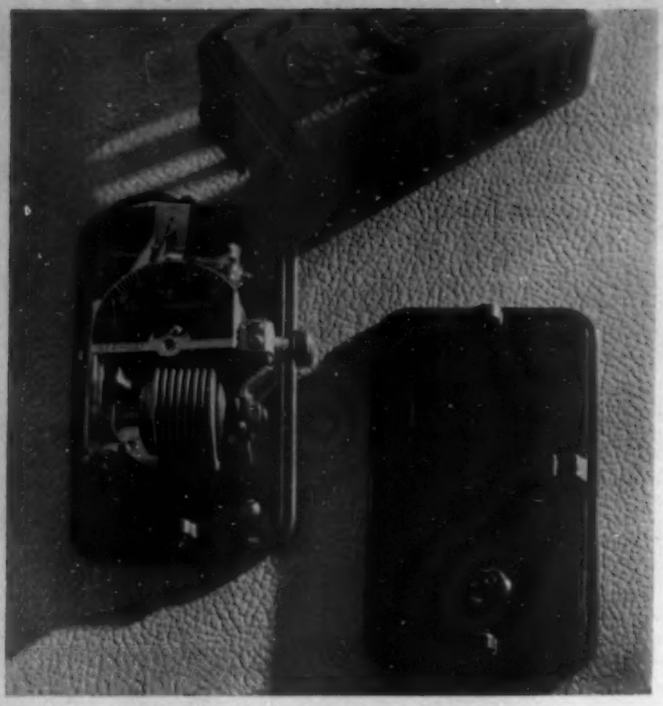


Left—"Polartron" and "Timerelay" units of Minneapolis-Honeywell Regulator Co. and some of the molded Durez parts. The company uses this material for thermostat base, shown at right, revealing recesses, alignment and fastening bosses molded in

EVERYTHING'S UNDER CONTROL

by CLARK R. SIMMONS and EDWIN E. WOODMAN*

Design, simplification, engineering construction of controls advance with today's plastic materials

THERMOSTATS, RELAYS, METERS, CIRCUIT breakers, portable recording and indicating voltmeters, analyzers, transformer cases and their brethren have all turned an attentive ear to the phenolic plastics manufacturers and molders. The extent to which the plastics story has been heeded is definitely reflected in the accompanying illustrations.

One does not have to go back many years to recall the wooden cases, the hard-rubber-lined boxes, machined hard rubber panels, backing plates, prevalent in this type of equipment. It's even easy to remember the widespread use of hot pressed gilsonite and asbestos. But these materials, although they offered great possibilities over any materials then available, still had their drawbacks. The gilsonite-asbestos compound was very susceptible to moisture. Voltage breakdown was low. It slumped with heat or became very brittle and lacked strength. Many applications required that it be very thick-walled, necessitating a bulky-appearing design, usually a decorative eyesore.

Hard rubber, although subject to change under heat, could be drilled and machined. Today's greatest volume material, punch grade phenol fibre or phenolic laminated sheet stock, is serving well. It, too, requires punching, drilling or machining. In many applications these materials may still be indispensable. But, considering the advantages offered by phenolic molding compounds it is easy to see why so much progress has been made in design, interior construction and even in increased uses for the various types of controls required in industry as well as in the home.

Remember the big, brutish-looking thermostats that you had to have on the wall—two and even three inches thick. Examine them today and you find them half the size or even less. What's more, you find them smart looking, harmonizing with surrounding fixtures, colorful if you want them, retaining an original lustre that is pleasing to the eye. Both the housing and the backing plate may be of molded plastic. Decoration, scale figures may be molded-in, recessed, then given a wipe-in of contrasting color enamel and excellent two-tone effect is secured. In most cases buffing, spraying, baking processes are eliminated. The housing is practically ready for use as it comes from the mold.

Consider the backing plate. Notice the bosses, recessed sections, slots, holes, guide boss, inserts—all molded-in in one operation. No punching, drilling,

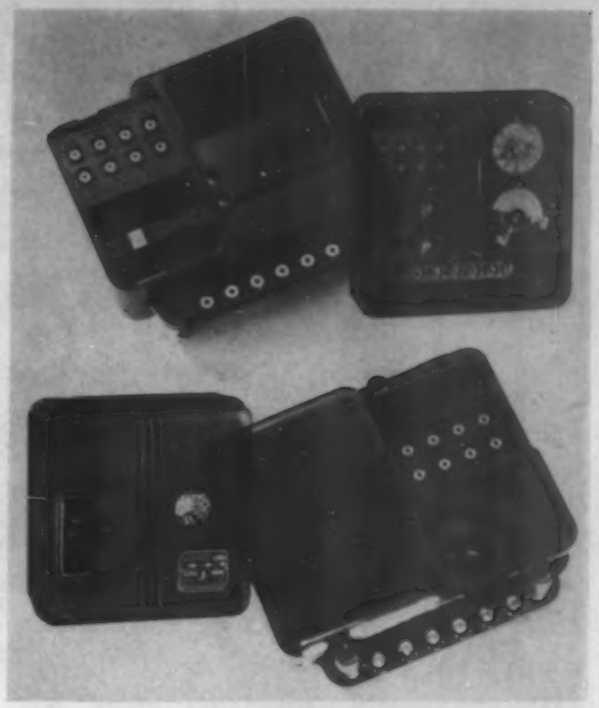
* General Plastics, Inc.

tapping are required. A light buffing removes the slight excess material pressed out in the mold and the plate is ready to use. It's unaffected by moisture, heat or cold, mild acids or alkalis—and it has excess strength for the job it may be called upon to do. There are some industrial applications of controls and recorders where plastics may not be suitable for housings because of the abuse to which they may be subjected. But, they mark the exception and not the general installation.

Air conditioning has opened a tremendous field for plastics but to date it has hardly been touched except by the controls manufacturer. Both the manual and automatic regulators employ plastics to a great degree. Because this material is unaffected by atmospheric changes, is not a conductor of heat or cold, its use enhances the functioning of the delicate interior mechanisms, assuring more finely responsive action.

Several specific types of controls are illustrated. Mainly these come under the pressure group, time group and temperature group, or a combination of two. Whether controls for refrigeration operate on the basis of line pressure or temperature, the plastic parts will be unaffected. Although some pressure types are not designed for use on systems employing corrosive refrigerants, there are special phenolic plastics made to withstand the corrosive action of such materials. In fact, more than four different plastic molding compounds are used in the various molded pieces shown.

Large unit heating systems may be operated from time controls. When these are set for a two minute operating period every half hour, for example, it's easy to realize the normal effect of continuous wear on the moving parts. Here again phenolic plastics prove their fitness. Tests have shown certain plastic materials to outwear metal. When these materials (*Please turn to page 64*)



Top—L. R. Teeple Co.'s "Syncrostat" control for Iron Fireman installations shows well-engineered plastic housing molded by Remler Co.—front and back view overprinted on complete model and with cover removed. Minneapolis-Honeywell's molded thermostat housing (directly above) is given spray finish of metal paint to obtain desired metal color. Left—Molded escutcheon and knob are used by Young Regulator Co. for a manual remote control air-conditioning regulator. All these are of Durez

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Fig. 1—Shows Alexander Calder's entry, which received first prize. One intersecting sheet is dark purple, the other is colorless transparent material. Red disk is superimposed on heavy rod. The whole sculpture is illuminated from concealed light source; sheets become edge-lit and extremities of rods show points of light. This sculpture is on display at the Röhm & Haas exhibit at the New York World's Fair. Fig. 2—Second prize winning design, submitted by Herbert Matter. Entire sculpture is colorless transparent resin excepting the suspended red sheet, to which is attached a flat section of white translucent material. Base is transparent sheet with under surface painted white

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PLASTICS SCULPTURE COMPETITION

by ELIZABETH CLARK

Amazing, perhaps, as plastic products, these abstractions express a new approach to the capabilities of the materials which may indicate new markets in murals, decoration and display

PLASTICS OFFER MANY EXCITING POSSIBILITIES to artists who are searching for new media. As they begin to work in plastics they discover entirely new sculptural properties, different from the properties of the materials which have heretofore been available. Techniques developed for work in wood or clay must be cast aside and the aesthetic and physical properties of the plastic studied to determine its artistic uses.

It was with the purpose of discovering a new technique expressing the capacities of the acrylic plastics as a medium for sculptors that a competition was undertaken last winter, sponsored by the Museum of Modern Art, New York. The idea of the competition was conceived by Gilbert Rohde, industrial designer, who acted as technical consultant.

The problem was to create a sculpture which would express in aesthetic terms the properties of the material, yet keep within the standard sizes, shapes and colors.

The response to the first announcements indicated that artists are seriously seeking new means of expression. Schools and museums requested detailed information about the competition to pass on to their classes. Almost 600 inquiries were received from practically every state in the union. Four hundred artists returned application blanks and 250 entries in sketch form were submitted, for preliminary consideration by the jury.

At its first meeting on February 20th the jury examined the entries and found that although there was a generally high artistic quality evident, a number of entries showed lack of understanding of the medium. The problem in many cases had not been studied through to its logical conclusion. Many attempted to portray subjects which would have been more fittingly executed in wood or clay. Others attempted designs which were either too difficult or impossible to execute, in the given medium, because of its inherent properties.

The fact that the five sketches selected to be executed full size turned out to be abstractions was the result, not so much of the disposition on the part of the jury, as it was that the abstractions considered the *quality* of the medium first, while the representational designs for the most part placed first emphasis on subject matter and secondly, on material.

It is interesting to note that among the winners is an abstract painter, a stage designer and a photographer. Although the competition was primarily for sculptors this fact shows that it aroused interest in others who had not, up to now—perhaps because of the limitations of existing media—thought of themselves as sculptors. A number of preliminary *(Please turn to page 68)*

Fig. 3—Werner Drewes' entry, was awarded the third prize. This sculpture, made entirely of transparent colorless material, exploits fully the ability of cast acrylics to be bent into curves, both narrow and deeply spherical. Fig. 4—A series of circular pieces with edges reflecting light comprises the entry of C. K. Castaing, awarded fourth prize in the sculpture competition. The sections are held together by a series of rods and pegs, which form the base. Fig. 5—Fifth prize winner, submitted by Xanti Schawinsky. Thin etched lines are drawn on the surface of a large transparent cube. A frosted sheet reflects light in the base. All plastic material used in these exhibits is Plexiglas

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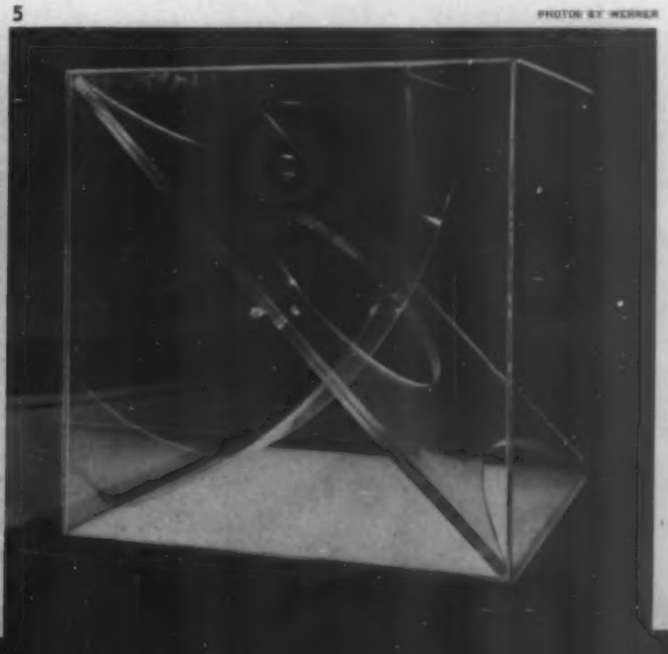
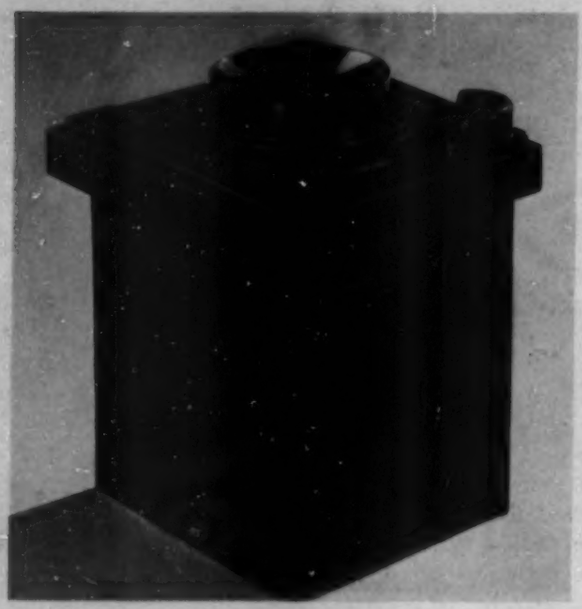
PHOTOS BY WERNER



WHERE ACCURACY IS PARAMOUNT

by DON MASSON*



Intricate molding of Fink-Roselieve's cut-film-pack developing tank (above) is by Boonton Molding Co. Complete parts, all Bakelite phenolic, are below

FOR MANY YEARS IT HAS BEEN RECOGNIZED that cameras employing cut films and film pack have a flexibility beyond the capacity of roll film cameras. However, the developing of cut film presented problems which were not solved until the construction of the all-plastic cut-film-pack tank for the Fink-Roselieve Co.

The three major problems in the construction of the tank were: 1. It had to be adjustable for a variety of lengths and widths of film; 2. Absolutely no light could be allowed to filter in through cracks or loose connections; and 3. There must be no chemical action between the developing solution and the all molded plastic tank and its fittings.

As far as avoiding chemical action was concerned, the selection of a special chemical resistant phenolic molding material solved this problem, leaving only the matter of adjustability and prevention of light infiltration to be settled. Obviously, an error in the dimensions of any one of the seven parts which went into the tank would upset its final function. The side slides had to be designed to go in only one way and not enter the tank the wrong way or upside down. (*Please turn to page 70*)

* Bakelite Corp.

ALLAN FRITZSCHE

DONALD DEW

HENRY J. KASCH

WILLIAM S. GROVE

MORRY BACHNER

CLINTON BLOUNT

WILLIAM T. CRUSE

EARL F. LOUGEE

WALTER F. RIEBOLD

S. P. I. ELECTS OFFICERS

THE BEAUTIFUL WESTCHESTER COUNTRY CLUB at Rye, N. Y., was host to the Society of the Plastics Industry from May 14–16 when the Society held its annual meeting to play golf and elect new officers for the ensuing year, with the largest attendance on record. The entertainment committee, composed of George Scribner, Theodore Marvin and W. F. Reibold, took complete charge of the gathering and provided so well that not a dull moment existed from beginning to end. (*Page 62*) Ninety-five were registered Sunday evening which is a record for initial attendance. One hundred and ten played golf on Monday and one hundred and sixty-five sat down at the banquet on Monday night.

At the business meeting, immediately after dinner, the following officers and directors were unanimously elected: Donald Dew, Diemolding Corp., Canastota, N. Y., president; Henry J. Kasch, Kurz-Kasch, Inc., Dayton, Ohio, vice-president; William S. Grove, American Insulator Co., New Freedom, Pa., secretary-treasurer; Morry Bachner, Chicago Molded Products Corp., Chicago, Ill., Clinton Blount, Bakelite Corp., New York, William T. Cruse, Celluloid Corp., New York, Earl F. Lougee, Modern Plastics, New York, and Walter F. Reibold, Waterbury Button Co., Waterbury, Conn., were elected directors. Allan Fritzsche, retiring president of the Society, was named chairman of the board.

Just before the business meeting a number of golf prizes were awarded and following the election, John Mullholland mystified the members with modern magic.

Among those present, with company and host affiliations, were:

Accurate Molding Company: Leo Adenbaum, Alex Adenbaum; American Cyanamid Co.: M. V. Wright, W. N. Finney, W. H. McHale, C. J. Romieux, Wm. J. Torres, G. W. Patterson: American Optical Co.: Dr. H. R. Moulton, American Insulator Co.: G. A. Johns, Wm. S. Grove; Armstrong Cork Co.; John Braught; Arrow-Hart & Hegeman: Geo. Carlson; Associated Attleboro Mfrs.: A. S. Blackinton, C. W. Douglas, A. O. Burgess, R. E. Burgess, Birger Stenberg; Auburn Button Works: W. E. High, G. P. Anderson, W. A. Freyer; Bakelite Corp.: E. W. Vaill, Jr., W. T. Cooper, D. A. Munns, Allan Brown, Gordon Brown, C. W. Blount, R. E. Brannan, Sanford Brown, Geo. Baekeland, C. A. Norris, David Buchanan, W. B. Hoey, J. E. Horn, E. L. Hobson, D. Kusanobu, J. M. Fenlin; Bakelite-Rogers Co., R. A. St. Laurent; Boonton Molding Co.: G. K. Scribner, F. K. Davidson, R. W. Post, C. J. Groos; Bridgeport Molded Produces Co.: James Berthold; Bryant Electric Co.: Roy Cunningham, T. F. Butterfield, Inc.: Edwin M. Robb; Catalin Corp.: Harry Krehbiel, Wm. Thiele; Celluloid Corp.: W. T. Cruse, W. P. Porter, W. J. A. Connor; Chicago Molded Products Corp.: W. L. Kelly, Morry Bachner; Commonwealth Plastics: W. M. Lester; Consolidated Molded Prod. Co.: T. L. Allen, I. Thomas, R. H. Allen, L. W. Freeman; Diemolding Co.: W. B. Ross, N. L. Stafford, Donald Dew; E. I. du Pont de Nemours & Co.: Robert W. Brokaw, Harold Paine, Walter Rahm, Frank H. Hoyt, Leslie Gillie, Roy Slipp, E. R. Johnston; Durite Plastics: C. C. Pickering, Jr., F. A. Morlock; Firestone Tire & Rubber Co.: C. H. Whitlock, General Electric Co.: W. H. Milton, Jr., G. M. Stone, T. E. Giblin; General Industries Co.: Allan Fritzsche (***Please turn to page 76***)

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S. S. PANAMA

Smart, fireproof, this ship inaugurates the new trend in safe and comfortable passenger-cargo transportation

TRAVEL IN THIS RESTLESS AGE HAS BECOME more than a pastime. It offers escape from the confinement of business pressure, untangles jittery nerves, restores calm. This is especially true when one travels at sea in modern ships.

Americans are fortunate in this respect. There are literally hundreds of opportunities on either coast; in the Great Lakes and the St. Lawrence; in the Caribbean and the Gulf; where established cruises provide this sort of relaxation for almost any period of time one can find to be away.

We are fortunate, too, in the fact that the popularity of such cruises has prompted coastwise transportation companies to provide better accommodations, more comfortable quarters, safer boats.

One of the more recent arrivals among the passenger-cargo vessels is the *S. S. Panama*, built at a cost of $4,000,000 for the Panama Railroad Steamship Company, which sailed on her maiden voyage to the Canal Zone via Haiti on April 27, this year. On July 6, the *Panama* will be followed in service by the *Ancon* and later by the *Cristobal*, sister vessels which are also being built at Quincy, Mass., in the Fore River Ship Yards of the Bethlehem Steel Company.

These three 10,000 ton ships, which are 493 feet in length and 64 feet in beam, were designed jointly by George Sharp, naval architect, and Raymond Loewy, industrial engineer. Mr. Sharp's specifications called for steel and other non-combustible materials in the walls, ceilings, floors and other structural parts of the three vessels, making the liners more fireproof it is claimed, than any ever constructed in the world.

Mr. Loewy was equally specific in his choice of decorating materials to provide public and private rooms with comfort and luxury without sacrificing any of the safety factors inherent in the ship's construction. Plastics of various types have been wisely used to create this result. Built primarily as cargo vessels (*Please turn to page 66*)

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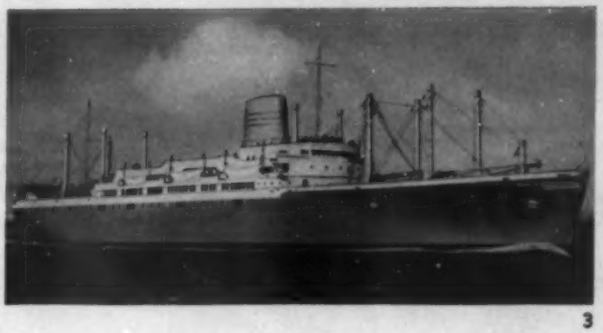

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Gray and white, the S. S. Panama (Fig. 3) is a gay ship as she sails the sea. Her interior is as attractive and comfortable as a modern club. The Main Hall (Fig. 1) is decorated in simple restrained modern with table tops of white Formica. Table lamps have Insurok shades. Wall lighting fixtures are half-bowls molded of Plaskon by General Electric. Lighting fixture over the stair has glass sections separated by half-round dividers of Plexiglas to relieve the design. The Lounge (Fig. 2) is a pleasant place for relaxation, bridge and group conversation. Fig. 4 indicates the feeling of brightness and gayety in the colorful Clubroom with its Formica tables, bar, sparkling stainless steel doors and cherry-red chairs

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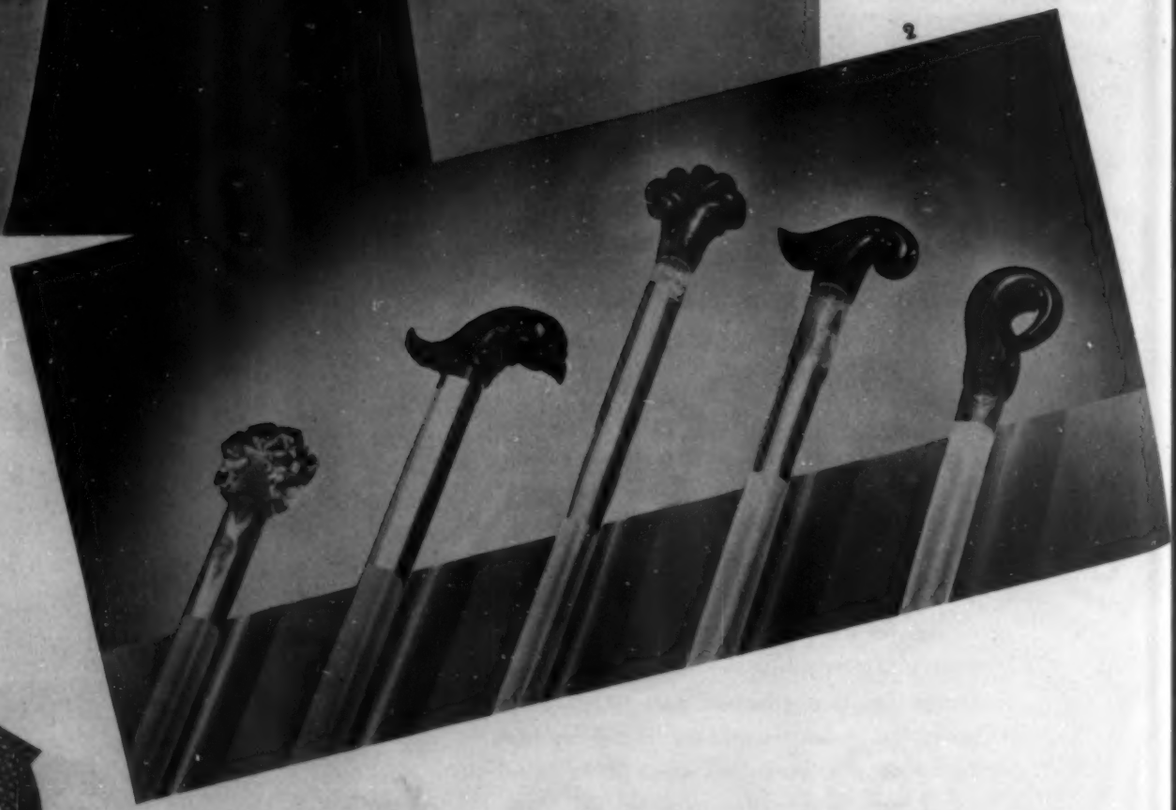

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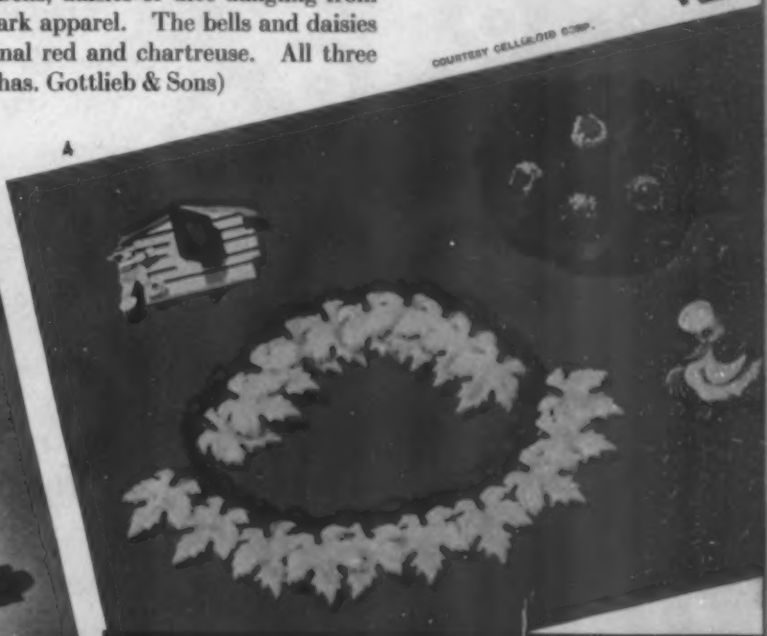
COURTESY DU PONT

SUMMER FANCIES by EVE MAIN

IN THE CITY, IN THE COUNTRY, AT THE SEASHORE, FASCINATING canes go walking this summer with the fairest ladies. Oscar Gold, of Ortho Plastic Novelties, Inc., designed them using crystal clear methyl methacrylate rods with handles and ferrules of the same material in jewel colors—topaz, emerald, sapphire, ruby and rock crystal. Delicately carved patterns tactfully conceal metal fastenings that hold handles and ferrules firmly in place. Colors may be chosen to match accessories as suggested by the young lady at the left (1). The bag frame carved from methyl methacrylate is the same topaz color as the curved handle of the walking stick. So transparent are the rods that when laid on a table (2) they pick up its color tones and the portion resting on the table appears frosty. Casual trinkets picked up here and there contribute blobs of color to warm weather attire. Sporty pin-ons (3) combine cast resin, cellulose acetate, metal and cork. (Chas. Gottlieb & Sons) (4) The heart-decorated door of a cellulose acetate brooch opens to disclose a tiny picture of one's love. (Cohn & Rosenberger) A cluster of flowers, leaf-decorated necklace and pompous Donald Duck are colorful ornaments fabricated from cellulose acetate by Geo. F. Berkander. White cast resin bells, daisies or dice dangling from cellulose acetate links (5) enliven the neckline of dark apparel. The bells and daisies are made in color, too—light pink, baby blue, signal red and chartreuse. All three designs have matching brooches and bracelets. (Chas. Gottlieb & Sons)

COURTESY CELLULOID CORP.



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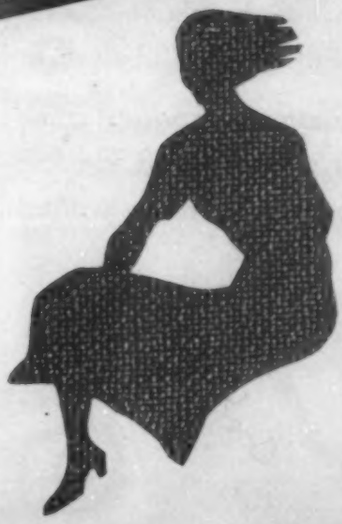

When good

THERE'S nothing novel about novelties. As sales builders they rank high in present day programs designed to increase sales.

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Take for instance this new Scraper Holder that is being distributed among the many high grade outlets of the Schaefer Brewing Company. "It's a winner," so their retailers say. But then, Plaskon is, too!

Molded Plaskon is the perfect material for items of this kind. It has great strength—resists breakage. It will not tarnish, rust, corrode or chip. Being solid molded color the finish is permanent. Scratching or abrasion do not injure its color value.

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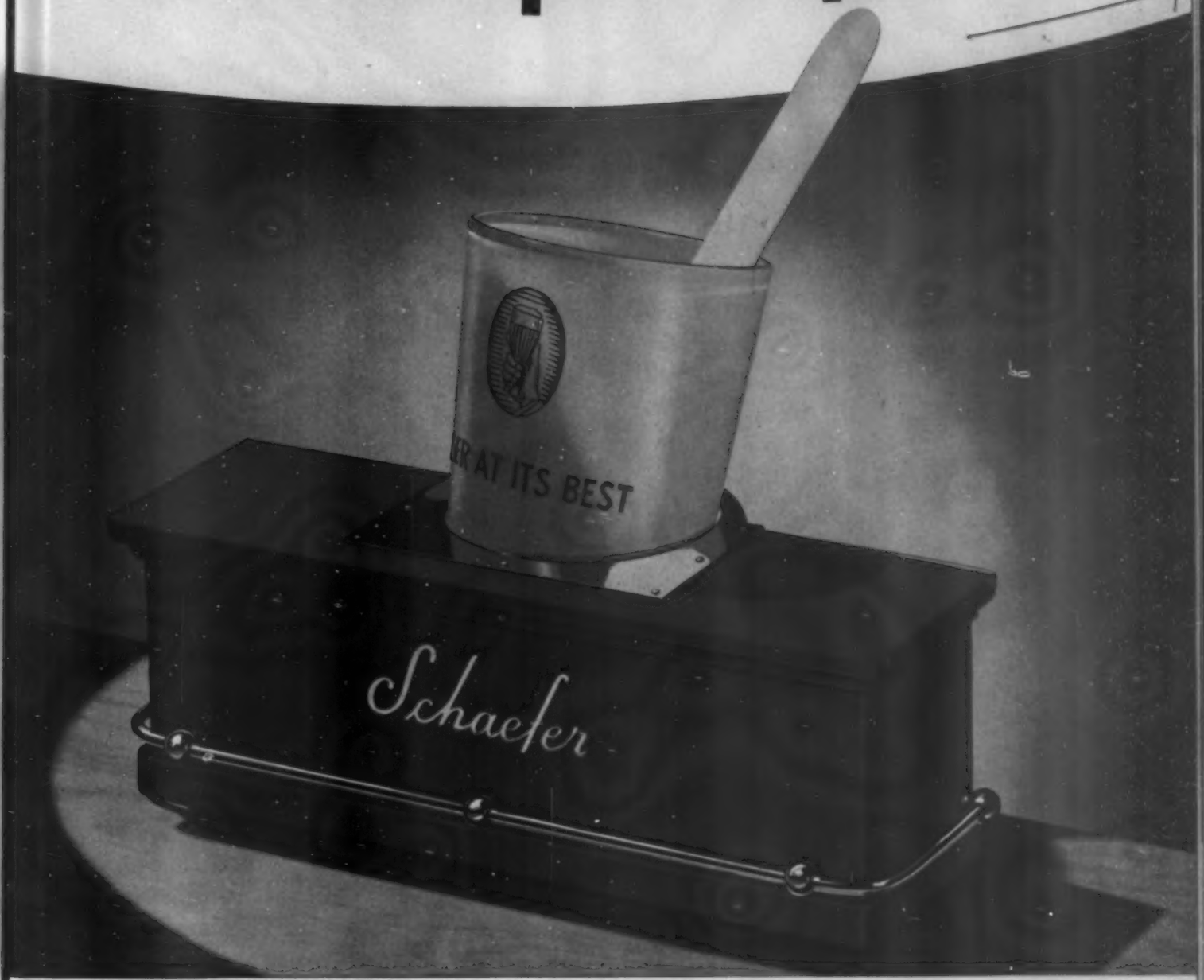
Canadian Agent: Canadian Industries, Limited, Montreal, P. Q.

fellows get together



Molded Plaskon in brilliant red with rail and glass holder made of chromium plated metal make this Schaefer "Scraper" Holder an eye catcher wherever displayed. In the form of a miniature bar it gently suggests to the thirsty customer a glass of cooling, healthful Schaefer's Beer. • This Plaskon molding is in one piece and measures 9 9/16" long, 3" wide, and 3 1/4" high overall. The weight is approximately 19 ounces.

Trade Mark Registered

PLASKON

★ MOLDED COLOR ★

1

2

PLASTICS

3

4

5

1. Quite an "eyeful" peers through each gigantic Lucite lense, $1^1/_2$ ft. in diameter, weighing 16 lbs. Huge spectacles, 50 times the size and 500 times the weight of ordinary ones, dramatize a new style of rimless glasses made by American Optical Company

2. Improved photographic paper cutter and trimming board, made by General Electric's Plastic Department for Besbee Products Corp., has a Textolite molded-laminated base. White lines and figures are put on by hot roll leaf instead of the ordinary rub-in method

3. Six Durez molded parts, including handle and knobs, are used on all washing machines in Montgomery Ward's new line, as well as on the sturdy de luxe model shown

4. Chiefly because of resistance to salt water corrosion, light weight and durability, Bakelite phenolic is employed by Penn Fishing Tackle Mfg. Co. for molding end plates of fishing reels and also for spools on the Penn Squidder

5. Mrs. Seaman Schepps designed this modern, decorative bird cage of transparent Lucite using split rods for the open basket-like area and pressed sheet for the top and bottom. This material is also used for perches, bath and feeding dishes inside. Sliding strips of Plastacele provide a wind-shield over lower half and facilitate entrance to the cage. Clever planning permits easy separation of all sections for cleaning. Circular in shape, with diameter of about 24 in., the cage has a false bottom that provides a level floor within. Supporting crane and rings are also Lucite. Not yet in commercial production

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S IN REVIEW

6. Mite-size nursery toilet sets, fabricated by Athol Comb Co. are made in blue or pink Monsanto plastic. Both comb and brush are super-soft, non-irritating to tender baby skins

7. Odorless, water and rust-proof Tappit server with container base easily pours ketchup, mustard, etc., in just the right quantity. Molded by Northern Industrial Chemical Co. for Food Dispenser Co. of Beetle or Durez

8. Tarnish-proof buckles and slides exactly match colors of leather or fabric of smartly styled Duke of Kent watch bands. Universal Plastics Corp. molded these for American Watch Strap Co. of light, durable Lumarith

9. Oven door handles and gas cocks molded by American Insulator Corp., of black Bakelite phenolic, red or white Plaskon, for Estate Stove Co., are inlaid by the Chilton process by Plastic Inlays, Inc. Molded recesses were .020 deep and top metal or portion of inlay showing is heavy chrome-plated brass

10. Indestructible, easy-grip, balanced handles of "Red Devil" putty knives and wall scrapers are made in two parts and attached to steel blades with rivets. Boonton Molding Co. molded these for Landon P. Smith, Inc., of red Tenite

11. Walnut Durez is used for the cabinet housing and control knobs of Majestic's handsome new radio. Molding is by Chicago Molded Products Corporation

Many of these items and others pictured throughout this issue are on display in our editorial offices during this month

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12. Acid and alkali-proof slide comparator for colorimetric determination of alkalinity of liquids is made by W. A. Taylor Co. Four intricate Durez parts were molded by Colt's Patent Fire Arms Manufacturing Company

13. Designed for dripless serving of syrup and honey, de luxe Tappit Whitehall model fits into a decorative matching base. Northern Industrial Chemical Co. molded it in Beetle or Durez in black, red and ivory with chrome trim

13

14. That "cupid's bow" of Lucile Ball, star of R. K. O. Pictures, Inc., is accentuated with a Melbern Sable-Glo Lip Brush. Ingenious case opens out when the brush is propelled up by pushing bottom section. Modern Plastics Co. molded it of Tenite

14

15. Lip-stick container of black Lumarith with white cameo affixed was molded by Universal Plastics Corp. for Valdor, Inc. Each is packed in transparent container of Lumarith Protectoid

16. Laminated Mah Jong blocks are cut from sheets 36 in. by 42 in. by Lamacoid Fabricators, Inc., for the Match King Co. Imprinted characters, incorporated in manufacture, form an integral part of the Lamacoid (Bakelite) sheet. Three black cores alternate with layers of white urea

15

17. Busy anglers find each compartment of the transparent "Rotaree" fly and lure box easily accessible by a one-handed turn and flick of the sliding opening. Clip attaches to belt or strap. Bill De Witt Division of Shoe Form Co. fabricated it of Monsanto Vue-Pak

18. Transparent place cards or gift enclosures, reproducing handwritten signatures are made by the Lehmanns from

16

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sheets of Plastacele. Narrow border and script are hand painted in white, gold and bright colors

19. Money flys—but not in Dudley-Crafts Co.'s airplane bank with combination right on the nose. Slot on top is for coins and bills are inserted through the bottom. Waterbury Button Co. molded it in Bakelite. Some are coated with aluminum finish on the plastic

20. "The Clock of Tomorrow," handsome, serviceable premium distributed by Gutman Bros., tells time all over the world. Pointer can be moved to indicate the hour shown on the revolving chromium dial, which is operated by a patented electric motor inside the globe. Base and Trylon, fabricated by Ivory Crafts Co., is of Marblette

21. Elkay Photo Products Co.'s film developer is molded of five chemical resistant Durez parts by Jos. Stokes Rubber Co. Inserting hexagonal-topped slotted stud, which slides over bar molded in the cylindrical bottom section, agitates the adjustable film holder in the tank. Top, slotted for easy removal of solution admits no light

22. Practically unbreakable, transparent instrument panel and clock crystal on the 1939 Nash are molded of Bakelite Polystyrene by Cardinal Corp. Letters and numerals are molded into the material at the back

23. Shiny silver, .999 fine, deposited on plastic by new, exclusive process, achieves an attractive, economical, lightweight fountain pen. Salz Bros, Inc., use Monsanto plastic as the base

Manufacturers addresses will be sent if you will write to the Editor enclosing 3-cent stamp for reply

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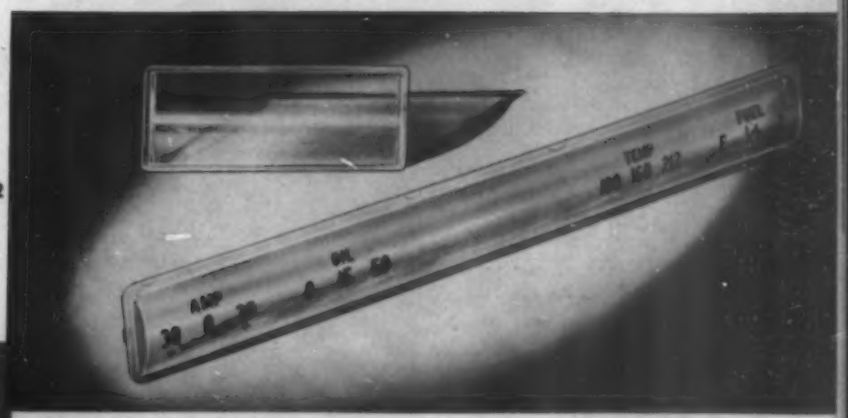

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S IN REVIEW

18

INJECTION MOLDING THERMOSETTING RESINS

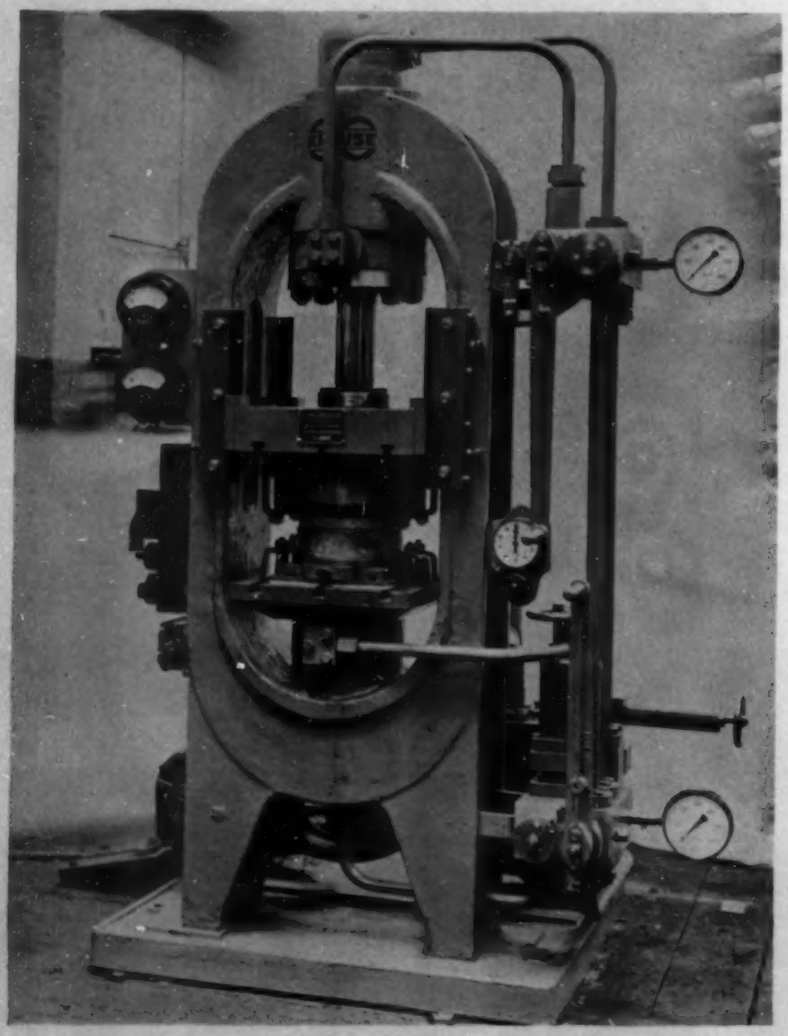
by JOHANNES NEUPERT

THE INJECTION MOLDING OF THERMOSETTING resins is rapidly becoming a popular technique because it shortens the curing cycle thereby increasing the output per press and permitting greater production capacity from a single mold. The Hyjecta Die Press manufactured by Johs. Krause, Hamburg-Altona, Germany, is the first press to reach the market which has been especially designed for this particular type of plastic molding.

It should be pointed out that these presses are only suited for handling thermosetting, or heat-hardening plastics and should not be confused in any way with injection presses created for thermoplastics. Phenol formaldehyde and urea formaldehyde resins are being successfully molded in these new presses both in Germany and in England. Although they have been on the market hardly more than a year, a great number is reported to have been sold and working to the entire satisfaction of users. At the recent Leipzig Fair a considerable number of orders was placed.

The die pressing, or injection, of plastic parts is distinguished from conventional compression methods in that the material to be molded is not immediately put into the mold and shaped under the influence of heat and pressure, but is first placed in a separate charge chamber preferably arranged within the pressing mold, where the material is exposed to pressure and squeezed through heated nozzles into the mold which is also hot.

In the nozzles, the material is intensively preheated, so that the hardening process is greatly shortened. Consequently, the working (*Please turn to page 70*)

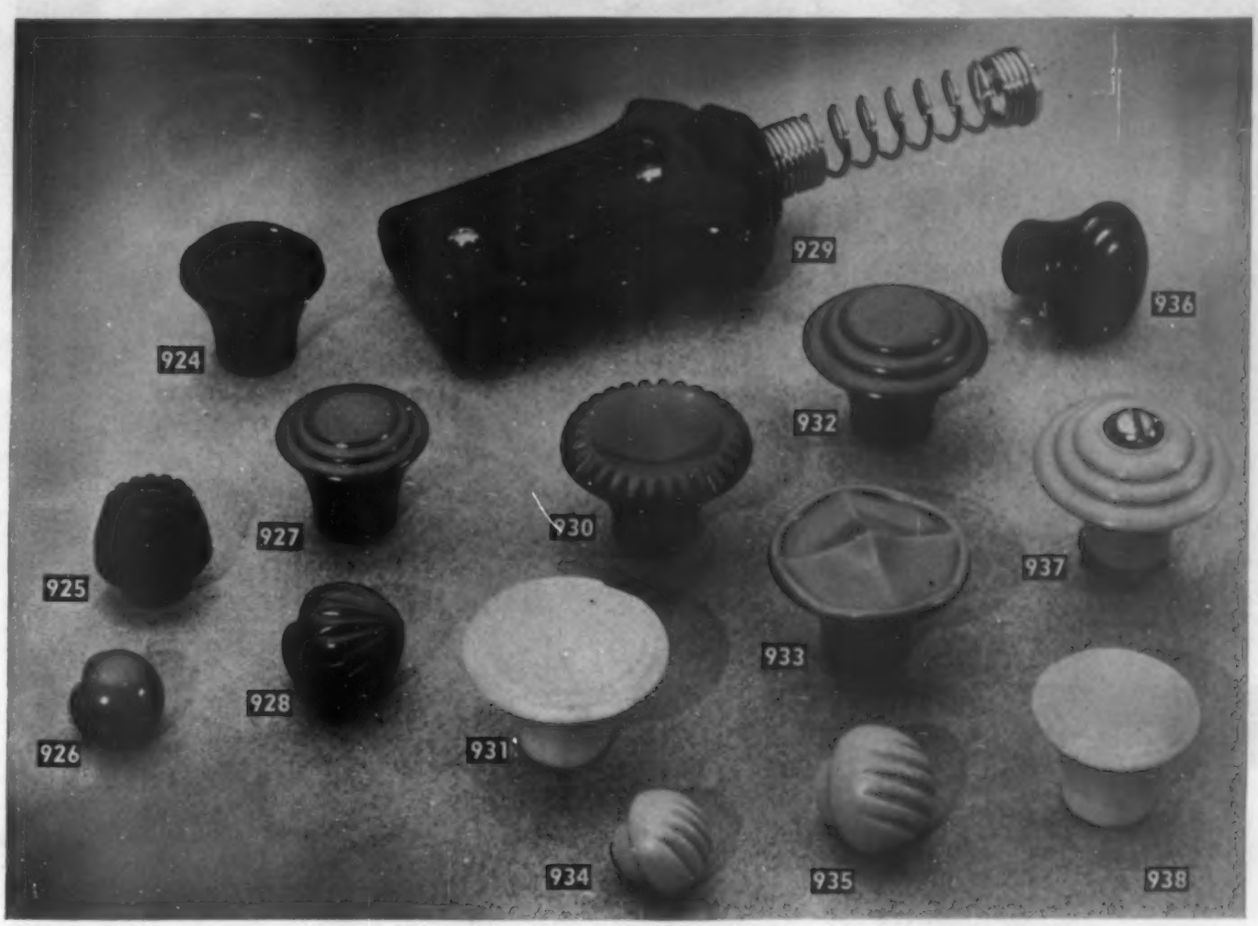


No claim is made by the press manufacturer that this process is new but so far as we know this is the first press designed especially for the production of thermosetting resins by the injection or transfer method to reach the market. So much has been published abroad that we asked our German correspondent to get the story, which we pass on to our readers as it was told to us.—Editor

Stock Molds

SHEET SEVENTY-NINE

Furniture, stoves, radios, automobiles are just a few of the items on which these decorative, practical knobs can be used. All are obtainable without mold cost from stock molds. Address Modern Plastics, Chanin Building, N. Y. C.



Sheets One to Fifty-Two reprinted in book form, 25¢ in coin or stamps

924. Tapering knob 7/8 in. in diameter at top, 3/4 in. high. Threaded metal opening 1/8 in. in diameter

925. Decorative knob 1/2 in. in diameter at top, 5/8 in. high. Threaded metal opening 1/8 in. in diameter

926. Round-top knob 1/2 in. in diameter and 1/2 in. high

927. Tapering knob 15/16 in. in diameter at top, 3/4 in. high. Threaded metal opening 1/8 in. in diameter

928. Decorative knob 11/16 in. in diameter tapering to a point at top, 3/4 in. high

929. Heater or appliance plug 2 3/8 in. long, 1 3/8 in. wide with a 1 3/4 in. shoulder. Two identical parts fastened together with screws and nuts. Metal cord-covering spring inserted at top

930. Tapering knob with fluted top edge, 3/4 in. high and 1 1/8 in. in diameter. Threaded metal opening 1/8 in. in diameter

931. Tapering knob with decorated top edge, 1 1/8 in. in diameter, 3/4 in. high and with 1/8 in. threaded metal opening

932. Tapering knob 1 1/8 in. in diameter at top, 7/8 in. high, with 1/8 in. threaded metal opening

933. Tapering knob with patterned top 1 1/8 in. in diameter, 7/8 in. high, with 1/8 in. threaded metal opening

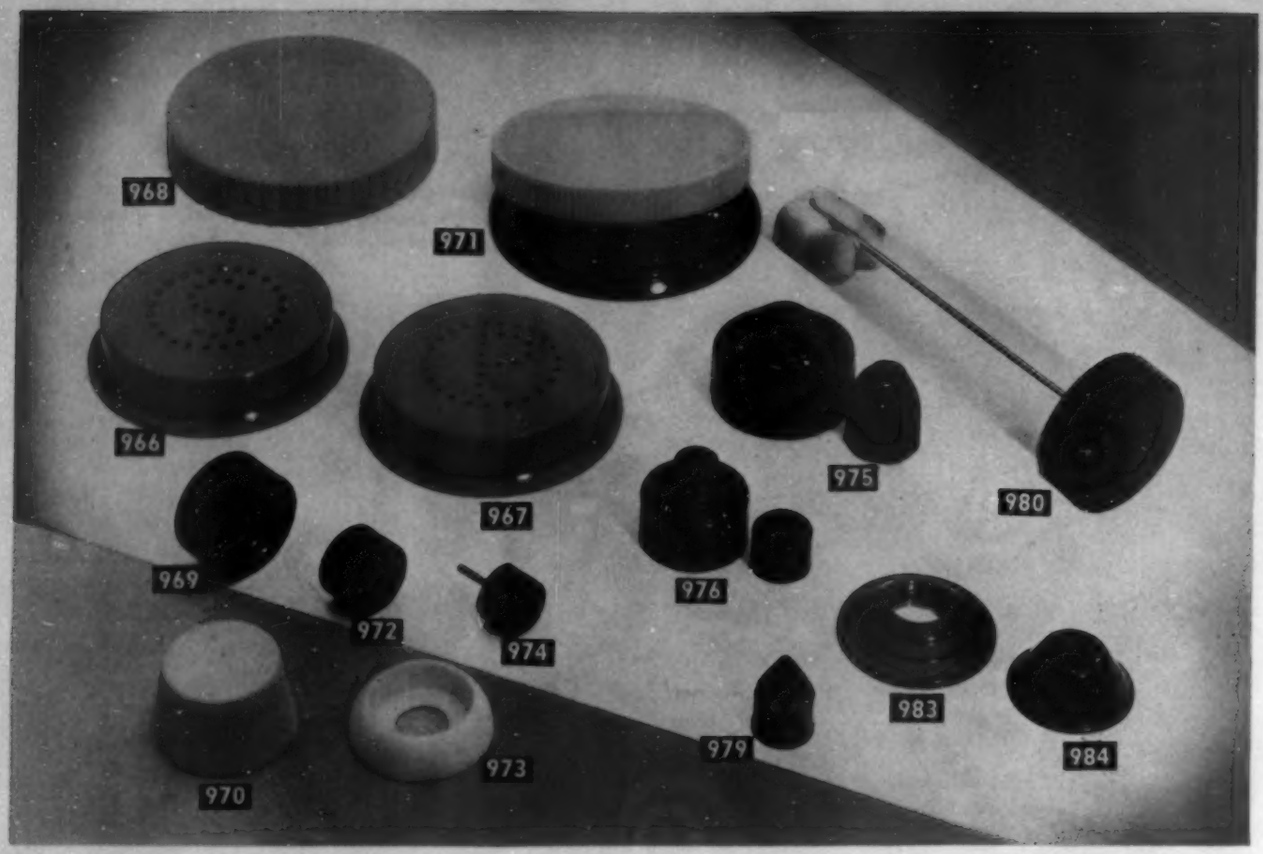
934. Ridged-top knob 9/16 in. in diameter and 1/2 in. high

935. Ridged-top knob 11/16 in. in diameter and 5/8 in. high

936. Tapering knob 7/8 in. in diameter at top, 13/16 in. high, with 1/8 in. metal shank

937. Tapering knob 1 1/8 in. in diameter at top, 1 in. high. Assembled with screw, washer and nut

938. Tapering knob with decorated top edge 7/8 in. in diameter, 3/4 in. high. Threaded metal opening 1/8 in. in diameter



Reprints of sheets One to Fifty-Two are available in book form. Twenty-five cents in coin or stamps

Stock Molds

SHEET EIGHTY

Shaker tops, compact, dauber, a variety of caps combine functional design with economy. Address all inquiries to Modern Plastics, Stock Mold Department, Chanin Building, N. Y. C. All molders are invited to send their samples to appear on this page as space permits

966. Salt shaker cap, threaded, with perforated letter "S" in circle of perforations. 1/2 in. high, 1 7/8 in. inside diameter, 2 1/4 in. overall diameter

967. Pepper shaker cap, same as above but with perforated letter "P"

968. Shallow finish cap, threaded, with fluted edge. 1/2 in. high 2 5/16 in. inside diameter, 2 9/16 in. overall diameter

969. Shallow finish well type cap, threaded, with ribbed edge. 7/16 in. high, 13/16 in. inside diameter, 7/8 in. overall diameter

970. Medium finish cap, threaded, with knurled edge. 5/8 in. high, 15/16 in. inside diameter, 1 1/8 in. overall diameter

971. Compact with light colored separate top. Knurled edge and grooves for decoration. 9/16 in. high, 2 9/16 in. overall diameter

972. Shallow finish well type cap, threaded, ribbed edge. 3/8 in. high, 9/16 in. inside diameter, 5/8 in. overall diameter

973. Escutcheon, 1 1/8 in. diameter with 3/4 in. hole at base. 5/16 in. high with 3/4 in. opening at top

974. Threaded cap with wire applicator. 5/16 in. high, 3/8 in. inside diameter, 7/16 in. overall diameter

975. Combination sprinkler cap, threaded, 1/2 in. high, 1 1/8 in. inside diameter, 1 1/4 in. overall diameter. Dome-shaped ribbed top 13/16 in. high, 5/8 in. diameter

976. Combination sprinkler cap, threaded, ribbed edge. 1/2 in. high, 13/16 in. inside diameter, 7/8 in. overall diameter. Sprinkler cap, 3/8 in. high, 7/16 in. diameter

979. Cone shaped, shallow finish decorative cap, threaded. 3/4 in. high, 3/8 in. inside diameter, 1/2 in. overall diameter

980. Shallow finish threaded cap with 4 in. dauber. 1/2 in. high, 1 1/4 in. inside diameter, 1 3/8 in. overall diameter

983. Pedestal cap, threaded with decorative ridges. 7/16 in. high, 1 1/4 in. diameter at base, with No. 20 opening, 7/16 in. diameter

984. Pedestal cap, same as above, 1 in. diameter at base with No. 16 opening, 3/8 in. diameter

METHYLOLTHIOUREAS

by DR. FRITZ POLLAK

ADDITION PRODUCTS OF THIOUREA AND FORmaldehyde were superficially mentioned in the early literature[1] but were not definitely identified. This may be due to the fact that the addition products obtained by the first reaction of these two products, the monomethylol- and dimethylolthioureas, possess great solubility in solvents and are easily decomposed at slightly elevated temperature. Hence it is more difficult to get them in a pure state than the corresponding products from urea and formaldehyde.

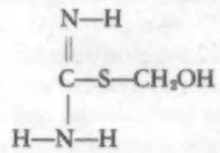
In British patent 319,251 there is found a description for making dimethylolthiourea, but no such product was obtained when the prescribed directions were followed. Instead, a derivative of thiodicyandiamidine was produced. This latter substance is well characterized by the red precipitate which it gives with solutions of lead salts.

Previous authors have mentioned that methylolthioureas could be obtained by the use of alkaline catalysts, quite similar to the old method of Einhorn and Hamburger.[2] Apparently they did not observe that both these products, monomethylol- as well as dimethylolthiourea, clearly exist in at least two different isomeric forms, which not only differ in melting points, but also in their reactions toward reagents, such as silver nitrate. Such different products obtained by using weakly alkaline and weakly acid catalysts are described in this paper. But it should be made clear that each single isomer may not have been isolated; it is quite possible that all the substances which were obtained are mixtures of such isomers in widely differing percentages. This appears the more probable in view of the fact that all of these products seem to be partly transformed into one another at elevated temperatures and especially in aqueous solution. Therefore, a method of production had to be developed in which the temperature would not exceed 50 deg. C. The total yield obtained amounted in all the experiments to nearly 100 percent.

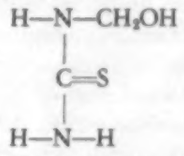
The mono- and dimethylolthioureas are substances which possess great tendency to crystallize, whether they are produced in an alkaline or in an acid solution. Obviously the use of any strong acids or alkalies must be avoided in this process, as the methylolthioureas are decomposed by such, even at room temperature. A 10 percent solution of acetic acid at about 100 deg. C. will transform the monomethylol derivatives into soft resinous substances, the dimethylol compounds into hard, glass-like insoluble resins.

Attention is also directed to a product (described below under 3) which, although obtained in a different way and showing a different melting point, gave on analysis figures for sulphur and nitrogen which are very close to those of methylolthiourea. Most of the analytical determinations were made in the laboratory of Dr. Friedrich at the Vienna University.

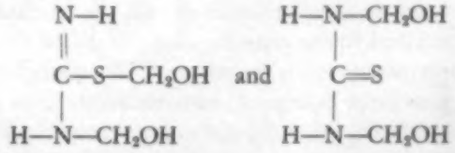
Summing up the results of this investigation, it seems to be of interest to note that some of the products described, when compared to pure thiourea, show a very reduced sensitivity to silver nitrate solution. This seems to make it most probable that in these substances the sulphur group must be protected in some way, and it is reasonable to conclude that the methylol group must be the protecting agent. The isomeric products must consequently be substituted on the nitrogen. Thus for the monomethylolthiourea which is insensitive to the silver nitrate reagent the probable formula is



and the isomer which reacts with the silver nitrate solution would be constituted as follows:



The corresponding dimethylol thioureas would be



A knowledge of the constitution of the methylolthioureas may to some extent allow conclusions on the chemical action taking place in the formation of resins of that class.

Experimental part

1. *Monomethylolthiourea from thiourea and formaldehyde in acid solution:* 12.67 g. of thiourea were dissolved in 100 ml. of water at 30–35 deg. C. Then 12.5 g. formaldehyde solution (*Please turn to page 74*)

References

[1] See Einhorn, Ann. d. Chemie **361**, 131–32 (1908); Ellis, *Synthetic resins and their plastics*, 1923, p. 592; Brit. patents 264,272 and 319,251.
[2] Ber der deut. chem. Ges. **41**, 24–28 (1908).

THE CLASSIFICATION AND CHEMICAL GENETICS OF ORGANIC PLASTICS*

by GORDON M. KLINE**

THE MODERN PLASTICS INDUSTRY MARKETS such an amazing variety of compositions of synthetic and natural origin that classification of these products on any basis other than according to their chemical source results in considerable overlapping. Thus, if plastics are divided into two groups based on their behavior toward heat, namely, (1) thermoplastic and (2) thermosetting, we find that phenolic-aldehydic and hydroxy-carboxylic resins would be represented in both classes. Likewise, listing plastics from the viewpoint of the methods in use for their fabrication into finished articles, for example, compression molding, injection molding, casting, laminating, and machining, would disclose that phenol-formaldehyde resins are processed by each of these methods. Differentiation according to behavior under various service conditions, such as exposure to chemical reagents, light, abnormal temperatures, and wet or dry atmospheres, while of immediate importance to the consumer, is not a convenient basis of grouping plastics when surveying the materials that are available.

The four principal types of organic plastics based on chemical source are (1) synthetic resins, (2) natural resins, (3) cellulose derivatives, and (4) protein substances. Rubber, also an organic material, is not generally included within the scope of the plastics trade as it is known today inasmuch as the rubber industry was already organized and developed prior to the advent of the present-day plastics. However, it is interesting to note, in a recent book[1] on modern rubber manufacture, a statement that the trend is away from the processing of rubber by mastication, and toward the development of rubber powders precipitated from latex and suitable for mixing with compounding ingredients and molding by the methods usually employed in the plastics industry. This is ascribed to the growing recognition of the superior properties for many purposes of rubber articles made from liquid latex compared with those made of rubber which has been subjected to the currently employed, exacting mechanical and heat treatment.

There is another group of synthetic materials which resemble the resins in molecular structure and many of their physical properties, but which, particularly in the cured or vulcanized state, have the additional property of being markedly elastic or rubbery. The efforts to classify these products have been marked by much fumbling and confusion, with such terms as "synthetic rubbers," "substitute rubbers," "rubber-like polymers," "rubber-like resins" and "rubber-like plastics" being employed for a generic name. Nearly every book or review written on the subject of synthetic resins has a section dealing with these hybrid materials, and, vice versa, every recent treatise on rubber includes a discussion of their synthesis, properties and applications.

Rubber itself, a polymer of isoprene, is closely related chemically to the many polymeric materials commonly called resins. It is also true, of course, that at low temperatures rubber behaves similarly to ordinary resins with regard to stretching properties. Indeed, it is thought that only by the grace of a *cis* arrangement[2] of the groups about the double bonds in the hydrocarbon molecule does rubber have its typical elastic properties instead of being the "hard, horny, inextensible mass" which is the *trans* stereoisomer of rubber and is known as gutta-percha hydrocarbon. The fact that many of the well-known members of the synthetic resin family exhibit rubber-like characteristics either in their partially polymerized form, or at elevated temperatures, or when suitably plasticized, makes the boundary between the "rubber" and the resin very vague indeed. If the difference between a rubber product and a resinous product is to be based on an arbitrary definition of percentage extensibility and retractivity, it is apparent that ebonite will fall into the class of resinous products just as correctly as suitably modified vinyl chloride and styrene resins are to be considered as rubbery products.

The principal difficulty in the use of the term "synthetic rubber" or "artificial rubber" as a generic name for these extensible polymeric substances is that the word "rubber" has become associated with a commercial product of well-established chemical constitution. This situation is analogous to that in which the word "rayon" was coined as a substitute for the expression "artificial silk" to denote various synthetic fibrous materials. It is probable that in the future there will be many new additions to the family of elastic substances of high molecular weight, some of which will have the butadiene nucleus, but only one of which will be synthetic rubber, i.e., polyisoprene. Others will

REFERENCES

1. Barron, H., "Modern Rubber Chemistry." Chem. Publishing Co. of N. Y., Inc. (New York) 1938.
2. Davis, C. G., and Blake, J. T., "The Chemistry and Technology of Rubber," page 120. Reinhold Publishing Corp. (New York) 1937.

* Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce. Presented as part of a symposium on "Plastics in the Electrochemical Industry" at the Rochester meeting of the Electrochemical Society.

** National Bureau of Standards

be quite dissimilar to the natural rubber molecule. It is, therefore, believed to be desirable to add another group to the four types of organic plastics previously listed to include these materials which are synthesized from small molecular units by reactions similar to those used in resin chemistry to build up macromolecules, but which have properties resembling more nearly those of rubber than those usually associated with the resinous state. It is important to keep in mind that to be molded into commercially useful objects these materials must at some stage be plastic, i.e., capable of being deformed by stress and retaining the deformed shape. It is as a rule only in the cured or vulcanized state that a high degree of elasticity is attained.

Ellis[3] has suggested that the term "lastics" be used as a generic name for the class of substances which possess rubber-like physical properties, irrespective of chemical structure. Various limits have been proposed for the minimum percentage of stretch which a substance, to be so classified, should be capable of undergoing with subsequent forcible retraction to substantially its original size and shape. Midgely[4] (employing the term "synthetic rubbers") has suggested that "it should be over 100, probably 400, possibly 600, but certainly not higher." However, it does not seem that an arbitrary limit of this sort is necessary, because in borderline cases, it will be the chief industrial application of the material which will largely govern its classification as a synthetic resin or a synthetic lastic by the chemists and engineers of the trade.

The real romance of this industry rests in the ability of the active and excited younger set of molecules to get together and form by condensation or chain growth the heterogeneous population of giants which we know as plastics. It is also the research into the genetics of these organic compounds that has paid dividends by enabling the chemist to create at will synthetic materials having the hardness of stone, the transparency of glass, the elasticity of rubber, or the insulating quality of mica. Because their chemical heredity and molecular configuration largely determine the properties of the finished products, our exploration of commercial plastics, in lieu of merely following the path of a census taker, will trace the development of these materials from their "single-cell" progenitors.

Synthetic Resin Plastics

The first group of the organic plastics mentioned in the introduction, namely, the synthetic resins, may be subdivided into several chemical types as follows: (1) phenolic-aldehydic, (2) amino-aldehydic, (3) hydroxycarboxylic, (4) vinyl, (5) acrylic, (6) styrene, and (7) indene resins. The first three types comprise the so-called condensation resins and the remaining four the polymerization resins. There are, of course, many other classes of organic compounds which will react together to form resins, as a survey of the patent literature on this subject will indicate. However, the resins which are included in the above list are those that are of chief commercial importance.

1. *Phenolic-Aldehydic Resins.* The phenolic-aldehydic type is from the standpoint of production the leading industrial member of the synthetic resins. The raw materials are generally formaldehyde and phenol or cresol, the latter consisting largely of metacresol with smaller amounts of the ortho- and para-isomers. In addition to these, other compounds containing phenolic groups such as xylenol and resorcinol and likewise various aldehydes can be used, but it will be noted in the following paragraphs that the simpler members of the various chemical groups are the ones commonly employed. These are usually cheaper, more readily available, and more reactive than the compounds of higher molecular weight. Phenol and cresol are obtained as by-products of the distillation of coal. Phenol may also be prepared synthetically by processes such as the alkaline hydrolysis of chlorobenzene. Formaldehyde, which is normally a gas, is made by the catalytic oxidation of methyl alcohol. It is usually obtained as an approximately 37-percent solution in water under the name "formalin," or it is converted to a solid for use as a further source of methylene groups in molding compositions by treating it with ammonia to form hexamethylenetetramine.

The increasing order of reactivity of the phenols with formaldehyde corresponds to their increasing susceptibility to curing. Thus, type 1 phenols have only one ortho or para position free for reaction with formaldehyde and can form resins only of the Novolak or permanently fusible type; 2,4-xylenol is an example. Type 2 phenols (e.g., ortho- and paracresol) have two active positions free and the resins formed from them are only partially or slowly curable. Type 3 phenols (e.g. phenol, metacresol, and 3,5-xylenol) have all three active positions free and can form completely and readily curable resins.

To facilitate a clear understanding of the condensation of phenol and formaldehyde Granger[5] studied its component stages separately. The first step consists in the formation of phenol alcohols by attachment of one or more formaldehyde molecules to the benzene ring to produce —CH_2OH groups at positions ortho and para to the phenolic hydroxyl. The second step in the resinification reaction consists in the condensation of the phenol alcohols. With acid catalysts the first step takes place more slowly than the second, so that in equimolecular mixtures of phenol and formaldehyde the monoalcohol is formed and undergoes condensation with phenol or another molecule of the monoalcohol before the di- or trialcohols can be produced. The resulting resin, therefore, behaves like that derived from a type 1 phenol and is permanently thermoplastic. In accordance with the well-known law of mass action in chemical reactions, a large excess of formaldehyde will favor the

3. Ellis, C., "Tailoring the Long Molecule." Ind. Eng. Chem. **28**, 1130–44 (Oct. 1936).

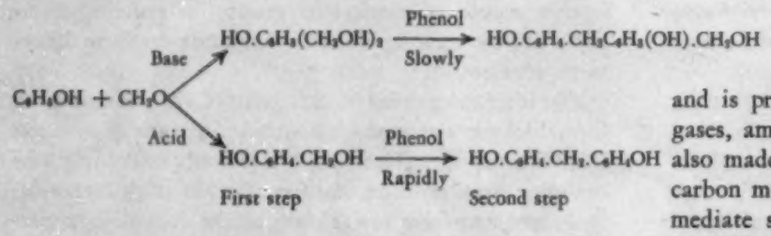
4. Davis, C. G., and Blake, J. T., "The Chemistry and Technology of Rubber," page 679. Reinhold Publishing Corp. (New York) 1937.

5. Granger, F. S., "Condensation of Phenols with Formaldehyde. I. Formation of Phenol Alcohol." Ind. Eng. Chem. **24**, 442–8 (April 1932). "II. Resinification of Phenol Alcohols." Ibid **29**, 860–6 (Aug. 1937). "III. Direct Resinification." Ibid **29**, 1125–9 (Oct. 1937). "IV. Variation of Phenols." Ibid **29**, 1305–8 (Nov. 1937).

formation of the di- and trialcohols and a completely curable resin can be obtained directly in acid media under such conditions. However, this is an uneconomical process since much of the formaldehyde is wasted and it is customary to state that non-curable resins are produced by condensation of phenol and formaldehyde under acid conditions.

On the other hand with alkaline catalysts the condensation of the phenol alcohols is much slower than their formation and hence the formation of the di- and even trialcohols is favored. Thus, if equimolecular portions of phenol and formaldehyde are heated together under alkaline conditions, about half of the phenol combines with all of the formaldehyde. Although more of the phenol is taken up during the subsequent condensation of the phenol alcohols, the molar ratio of formaldehyde to phenol in the final resin is in excess of equimolecular, resulting in high curability.

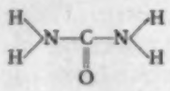
The reactions of phenol and formaldehyde under acid and alkaline conditions, respectively, may be summed up[6] as follows:



In the formation of resins the products of the second step in the above reactions condense with each other and with more phenol and formaldehyde to produce molecules with fairly long chains (stage A products or resols). The polyalcohols produced in alkaline solutions are highly reactive and will form cross linkages between the macromolecules to yield first an insoluble resin (stage B product) and finally an infusible three-dimensional molecule (stage C product). The less reactive compounds of the dihydroxydiphenylmethane type formed in acid media yield only linear molecules, which are thermoplastic and are called Novolaks.

Articles made with the phenol-formaldehyde resins possess those general properties which are characteristic of the organic plastics, namely, resistance to atmospheric and chemical corrosion, lightness in weight, low heat conductivity, and good electrical insulation. The molded products are usually made in black or brown colors; the lighter colors, but not the pastels, can be produced and are obtainable at an increased cost. The many uses of the phenol-formaldehyde molded parts include applications in the automotive, electrical, radio, telephone, building and decorative fields as well as for novelties and packaging accessories. The cast phenolic resins lend themselves readily to a variety of beautiful color effects and a finish comparable to that of precious stones. They are widely used for clock cases, jewelry, handles, automobile accessories, and related merchandise where their characteristic physical properties add charm and distinction to strength and durability. The phenolic resins are also made into useful industrial products by impregnating paper or cloth with them and pressing many layers into a hard, dense sheet which possesses excellent mechanical and dielectric properties. These laminated materials find many applications in the radio, aircraft, power, telephone, and building fields. Large quantities of the phenolic resins are used in the formulation of varnishes and cements, for which purposes their resistance to water, weathering, and mold growth are of advantage.

2. *Amino-Aldehydic Resins.* Although research has disclosed that many resinous substances are obtainable by the interaction of aldehydes and amines, only one such resin has become important commercially, that prepared from urea and formaldehyde. Urea has the structural formula



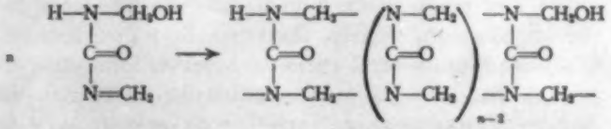
and is produced commercially by the reaction of two gases, ammonia and carbon dioxide. Formaldehyde is also made by synthesis from two gases, hydrogen and carbon monoxide, through methyl alcohol as an intermediate stage. The initial reaction of the urea and formaldehyde involves the formation of mono- or dimethylolurea:

$$NH_2CONH_2 + CH_2O \rightarrow NH_2CONH(CH_2OH) \xrightarrow{+\,CH_2O} NH(CH_2OH)CONH(CH_2OH)$$

Treatment of these compounds with acids or with heat alone causes the loss of water and results in the formation of an azomethine group which is an active polymerizable group:

$$NH(CH_2OH)CONH(CH_2OH) \xrightarrow{-H_2O} NH(CH_2OH)CON{=}CH_2$$

The compounds so formed are not isolated as such, but react with one another, probably by both condensation and polymerization mechanisms to form compounds of varying composition. This process may be represented as:



Of course, if there are primary amino groups present, the loss of water may involve the hydrogen atoms of these groups. It is also obvious that there will be considerable branching of the chains and also the formation of three-dimensional molecules. It is this latter feature which has become recognized as essential if a resin is to undergo thermal hardening.

Urea-formaldehyde molding (*Please turn to page 72*)

6. Megson, N. J. L., "Catalysts in Phenol-Formaldehyde Condensations." J. Soc. Chem. Ind. 57, 189-97 (June 1938).

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Plastics Digest

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them

General

PLASTICS IN PHOTOGRAPHY. D. MacMaster. Trans. Inst. Plastics Ind. *8*, 9–18 (Jan. 1939). Modern photography has been made possible by such well-known plastic bodies as film base. The manufacture of film base from cellulose nitrate and cellulose acetate is described. Other uses of plastics in camera parts and developing equipment are briefly surveyed.

CELLULOID: ITS MANUFACTURE AND USES. W. G. Wearmouth. Trans. Inst. Plastics Ind. *8*, 69–75 (Jan. 1939). A review.

ASPECTS OF HIGH POLYMERIC CHEMISTRY. H. Mark. Nature *142*, 937–8 (Nov. 26, 1938). A discussion of the relation of heat-, oil-, and water-resistance, impact strength, abrasion, electrical resistance, and reversible elasticity of high polymeric materials to their chemical nature, length of the molecular chains, internal flexibility, and linkages between the chains (netting numbers).

PLASTICS. A. J. Weith. Ind. Eng. Chem. *31*, 557–62 (May 1939). An historical review.

Materials and Manufacture

PLASTICS FROM WOOD WASTES. E. C. Jahn. Chem. Met. Eng. *46*, 206–7 (Apr. 1939). A review of numerous developments of wood plastics that are under way in this country, together with a discussion of the preparation and molding of gelatinized wood at the Idaho School of Forestry. A table gives modulus of rupture, modulus of elasticity, and specific gravity values for various wood plastics.

TYGON, MODIFIED HALIDE POLYMER. J. M. W. Chamberlain. Chem. Industries *44*, 401–3 (Apr. 1939). The uses of this corrosion-resistant material range from molded and extruded articles to linings for tanks, pipes, and process equipment, besides many applications for chemical plant and laboratory service.

A KETONIC ORGANIC GLASS. K. W. Pepper. Brit. Plastics *10*, 609–10 (Apr. 1939). Quantitative details for the preparation of a transparent resin from methyl ethyl ketone and formaldehyde.

COLORLESS KETONIC RESINS. Rev. Gen. Mat. Plastiques *11*, 70–3 (Mar. 1939). A review of the chemistry of these materials (not complete in the one issue).

CHEMICAL STABILITY OF LAMINATED PLASTICS. W. Paul. Kunststoffe *29*, 109–11 (Apr. 1939). Data concerning the resistance of both phenolic and urea plastics to various chemical reagents are cited.

Molding and Fabricating

THREADED HOLES IN LAMINATED PLASTICS. A. L. Valentine. Am. Machinist *83*, 179–80 (Mar. 22, 1939). Ground thread taps of high-speed chromium-plated steel tap approximately 1200 holes before resharpening is required. Taps with three flutes produced better finished threads than did four-fluted taps. Cool compressed air is the best "lubricant." Tapping speeds found to give the longest life are:

Diameter of tap (in.)	Revolutions per minute	Surface speed feet/min.
0.0590	3,500	54
0.0787	2,575	53
0.0984	2,020	52
0.1181	1,650	51
0.1378	1,390	50
0.1575	1,165	48
0.1772	993	46
0.1968	855	44
0.2165	742	42
0.2362	647	40

INJECTION MOLDING OF THERMOSETTING PLASTICS. A. Amigo. Brit. Plastics *10*, 579–81, 628–34 (Mar. and Apr. 1939). A review of the development of presses for injecting heat-hardening resins.

Applications

PLASTIC MATERIALS FOR AIRCRAFT CONSTRUCTION. N. A. de Bruyne. Brit. Plastics *10*, 515–9 (Feb. 1939). A reinforced plastic (Gordon Aerolite) made with resin-impregnated linen fibers has a tensile strength of 45,000 lbs./sq. in., compressive strength of 24,000 p.s.i., Young's modulus of 6.0×10^6 p.s.i., shear strength of 5000 p.s.i., and a specific gravity of 1.43. The methods of forming the material into spars and making suitable joints for aircraft members are outlined. The organic materials are said to be equally useful for lightly loaded and heavily loaded aircraft structures.

COMPARATIVE STUDIES OF METAL AND PLASTIC BEARINGS. R. Strohauer. Zeit. Vereines Deut. Ing. *82*, 1441–9 (Dec. 17, 1938). An apparatus for testing bearings is described and some experimental results are presented and discussed.

PLASTICS FOR BEARINGS. H. W. Rowell. J. Inst. Mech. Eng. *141*, 20–2 (Mar. 1939). Complete text and discussion of the paper abstracted in MODERN PLASTICS of Feb. 1939, page 48.

TYPE FROM PLASTICS. M. E. Laeis. Kunststoffe *29*, 17–8 (Jan. 1939).

SYNTHETIC RESINS IN PRINTING. A. Lafay. Rev. Gen. Mat. Plastiques *14*, 289–92s (Dec. 1938). This and the preceding article pertain to the uses of plastics in the manufacture of printing type, inks, and rollers.

WOOD-FACED LAMINATED MATERIAL. Engineer *166*, 742 (Dec. 30, 1938). Developed for strengthening wood members in aircraft construction, this material reduces to one-half the number of bolts required in joining wing spars to fuselage. The new material has a high bearing strength, permissible loading being 25,000 lbs./sq. in.

PLASTICS FOR PERFUMERS. Modern Pkg. *12*, 62, 93 (Apr. 1939). Packages for cosmetics and perfumes are described and illustrated.

Testing

CHEMICAL TESTS FOR SYNTHETIC SUBSTANCES. L. Metz. Brit. Plastics *10*, 511–4 (Feb. 1939). The chemical tests considered include qualitative identification, physico-chemical measurements, and stability in the presence of various chemicals.

DETERMINING WATER VAPOR PERMEABILITY OF SHEET MATERIALS. G. J. Brabander. Paper Trade J. *108*, 39–43 (Jan. 26, 1939). The test method recommended by a committee of the Technical Association of the Pulp and Paper Industry is set forth and some test results are discussed.

MEASUREMENT OF DIFFUSION. Trans. Illuminating Eng. Soc. *34*, 109–21 (Jan. 1939). A progress report of the Subcommittee on Diffusion of the Committee on Characteristics of Illuminating Materials. The results of tests on glass, plastics, and window shade materials are presented and the problem of reproducibility of diffusion measurements is considered.

INVESTIGATION OF IMPACT STRENGTH OF PLASTICS. W. Kuntze and R. Nitsche. Kunststoffe *29*, 33–41 (Feb. 1939). The critical effects of hammer weight and velocity on the values obtained for impact strength are demonstrated.

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THE NEW WAY OF ILLUMINATION

on Parade at the World of Tomorrow

New wonders of science and light . . . new magic with illumination . . . exhibits and buildings alive with colorful models and displays. This is the New York World's Fair.

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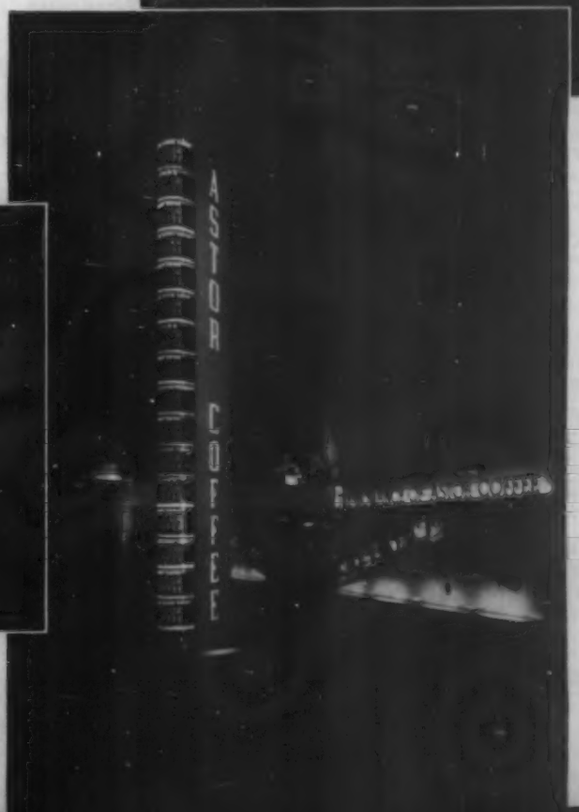

Top:—Brilliant red Translucent Lamicoid accentuates this design motif in Maison Coty. Center:—Colorful lettering and flashing replicas of the Astor Coffee can—both on Translucent Lamicoid. Above:—Exterior lighting fixtures on the Incubator Exhibit—with scarlet disc of Translucent Lamicoid.

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"Gang Busters"
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Remington-Rand Exhibit
Parke-Davis Exhibit

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

DUPLICATING PAD. Johan Bjorksten (to Ditto, Inc.). U. S. 2,153,324, April 4. A duplicating pad or roll is made of acrylate resin sheeting.

PALE ALKYD RESINS. H. C. Cheetham and Wm. L. Evers (to Resinous Products and Chemical Co.). U. S. 2,153,511 and 2,153,512, April 4. Inhibiting the formation of colored substances in alkyd resins (modified with fatty oils or oil acids) by adding organic phosphite esters; and utilizing organic phosphites in a similar manner in cooking varnishes.

ETHYLENE POLYMERS. E. W. Fawcett, R. O. Gibson and M. W. Perrin (to Imperial Chemical Industries, Ltd.). U. S. 2,153,553, April 11. Making tough solid polymers of ethylene, with molecular weight at least 6000 by high pressure thermal polymerization.

ADHESIVES AND SAFETY GLASS. Wm. H. Moss (to Celanese Corp. of America). U. S. 2,153,584 and 2,153,585, April 11. Adhesives for cellulose derivative films and foils are made of gelatin, sugar and an alkyd resin; and a similar alkyd resin is used for bonding cellulose derivative interlayers to gelatin-coated glass plates in making safety glass.

LAMINATED ARTICLES. Geo. I. Clapp. U. S. 2,153,660, April 11. Using a thermosetting synthetic resin as bonding agent in making laminated paper or fabric articles.

BEADED FABRIC. D. G. Higgins (to E. I. du Pont de Nemours and Co.). U. S. 2,153,755, April 11. Decorating opaque fabric by firmly attaching thereto particles of transparent methyl methacrylate resin at regular intervals.

AMINE RESIN. A. G. Hovey and T. S. Hodgins (to H. Reichhold, Reichhold Chemicals). U. S. 2,153,801, April 11. Condensing isobutylamine with a polycarboxylic acid to form a resin.

PLASTICIZED RUBBER HYDROCHLORIDE. Wm. C. Calvert (to Wingfoot Corp.). U. S. 2,153,954, April 11. Plasticized rubber hydrochloride foil is used for making raincoat sheeting.

INSULATING WIRE. R. H. Thielking (to Schenectady Varnish Co.). U. S. 2,154,057, April 11. A baking varnish for coating wire is made from a polyvinyl acetal resin.

ABRASIVES. N. P. Robie (to Carborundum Co.). U. S. 2,154,185, April 11. A resin binder which is difficultly fusible but can be softened with a solvent, is used for bonding abrasive grains; the binder is exposed to solvent vapor under pressure.

DECALCOMANIA. J. B. Carr and H. C. Rathke (to Meyercord Co.). U. S. 2,154,198, April 11. A decalcomania backing is coated with a plasticized vinyl resin overlaid with a transfer film composed of lacquer, the exposed face of which is composed of phenac resin and ethylcellulose.

MOLDED ARTICLES. Otto Hauffe (to Deutsche Celluloid-Fabrik). U. S. 2,134,203, April 11. An interpolymer of vinyl chloride and chlorinated vinyl chloride is plasticized with ethyl formate, molded and treated with water to hydrolyze the ethyl formate.

EXTRUDING PLASTICS. Adolf Kampfer. U. S. 2,154,333, April 11. Forming a sheet of high polymer, which softens above 100° C., and applying the sheet to a preheated support by extruding the softened polymer through a heated slot onto the hot backing.

ABRASIVES. W. E. Catlin (to E. I. du Pont de Nemours and Co.). U. S. 2,154,436, April 18. Using a synthetic linear condensation polyamide as a bond for abrasives.

DECORATIVE PLASTICS. F. R. Conklin (to Eastman Kodak Co.). U. S. 2,154,438, Arpil 18. Obtaining variegated effects in cellulose derivative plastics, by milling lumps of prepared plastic into a sheet of cellulose derivative having different light transmitting and reflecting properties.

VARNISH RESIN. I. Rosenblum. U. S. 2,154,471, April 18. Making an oil-soluble alkyd resin by condensing partially acetylated glycerol in acetic acid solution with rosin and succinic acid till all the acetic acid is expelled.

CAST RESINS. L. T. Sutherland (to Barrett Co.). U. S. 2,154,541, April 18. Making cast resins by alkaline condensation of phenol or a cresol with formaldehyde, removing water from the product and heat-curing the resin in a mold.

SHOE STIFFENER. W. Howard (to Celastic Corp.). U. S. 2,154,571, April 18. Making molded counter stiffeners by impregnating one portion of porous flexible blanks with a thermoplastic, and the other portion with a resilient substance, then drying and molding.

GLASS SUBSTITUTES. O. Röhm and W. Bauer (to Röhm and Haas Co.). U. S. 2,154,639, April 18. Making flat sheets of methyl methacrylate or styrene polymers, or their interpolymers with other substances, by forming edge-sealed cells between pairs of metal or glass plates, spaced apart to the desired thickness by plastic spacers, and filling the cell with the polymerizable substance.

ROSIN ESTERS. P. Schoorl (to Hercules Powder Co.). U. S. 2,154,704, April 18. Polymerizing rosin esters to increase the viscosity and raise the melting point.

ADHESIVE. H. A. Winkelmann and J. P. McKenzie (to Marbon Corp.). U. S. 2,154,798, April 18. Compounding rubber hydrochloride with a liquid rosin ester to make a permanently tacky adhesive.

WRINKLE FINISH. H. R. Moore (to New Wrinkle, Inc.). U. S. 2,154,954, April 18. Making wrinkle finishes from tung oil and an alkyd resin, which may be modified with fatty acids from non-drying oils, or with a phenol-formaldehyde resin or a rosin ester.

OIL-MODIFIED RESIN. H. L. Bender (to Bakelite Corp.). U. S. 2,154,969, April 18. Condensing a phenol first with an unsaturated fatty oil in alkaline medium, then with a formaldehyde derivative.

SAFETY GLASS. H. W. Matheson. U. S. 2,155,142, April 18. Using a partially hydrolyzed and acetalized polyvinyl ester as a safety glass interlayer.

(Please turn to next page)

ANNOUNCING

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5. They are tasteless, odorless, and non-toxic.

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"VINYLITE" resins

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Also available are molding powders, extruded shapes, coated paper, film, and acetal safety glass resin.

The word "Vinylite" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

MULTICONDUCTOR CABLE. M. M. Safford (to General Electric Co.). U. S. 2,155,243, April 18. A flameproof, multiconductor cable has the spaces between conductors filled with asbestos and a flameproofing agent, a flameproofed asbestos belt around the conductors and filling, and a jacket of asbestos tape impregnated with a plasticized polyvinyl chloride resin.

PREPARING PLASTICS. F. R. Conklin (to Eastman Kodak Co.). U. S. 2,155,303, April 18. Making molding compositions from cellulose acetate, propionate or butyrate by milling with a plasticizer on hot rolls until the moisture content is below 0.5%.

SOLUBLE RESIN. Max Paquin (to General Aniline Works, Inc.). U. S. 2,155,328, April 18. Making a water-soluble resin by condensing propylene oxide with ethylenediamine and heating the product with urea.

GASKET. Wm. M. West (to Crown Cork and Seal Co.). U. S. 2,155,457, April 25. Making a gasket of chloroprene and bodied tung oil, with fibrous filler.

CROWN CAP. S. I. Wilbur (to Crown Cork and Seal Co.). U. S. 2,155,574, April 25. An adhesive for use in crown caps is made of ethylated shellac and a cellulose ester or a vinyl resin.

PLASTICIZER. B. S. Garvey (to B. F. Goodrich Co.). U. S. 2,155,590 and 2,155,591, April 25. Plasticizing rubber or vulcanizable resins with a diolefin in which the double bonds are not conjugated.

RUBBER-LIKE RESIN. T. F. Bradley (to American Cyanamid Co.). U. S. 2,155,639, April 25. Making infusible, insoluble, flexible, rubber-like resins by condensing long chain glycols with tetracarboxylic acids.

SURGICAL PREPARATION. W. O. Herrmann and W. Haehnel (to Chemische Forschungsgesellschaft m. b. H.). U. S. 2,155,658, April 25. A preparation for filling body cavities comprises polyvinyl alcohol and a solvent.

RESIN. R. A. Jacobson (to E. I. du Pont de Nemours and Co.). U. S. 2,155,863, April 25. Condensing a substituted hydantoin with formaldehyde to form a resin.

COLOR-FAST RESIN. J. B. Rust (to Ellis-Foster Co.). U. S. 2,155,907, April 25. A varnish resin which can be bleached by heat and is then color-stable even in presence of driers, is made by condensing diphenylolbutane or higher diphenylol hydrocarbons with acetaldehyde.

REACTIVE RESIN. E. E. Novotny (to Durite Plastics, Inc.). U. S. 2,156,124, April 25. A potentially reactive phenolic resin including in its composition a hexamethylenetetramine addition product.

SOLUBLE RESIN. J. Rivkin (to Neville Co.). U. S. 2,156,126, April 25. Making alcohol-soluble resins by reacting the polymerizable components of solvent naphtha with a phenol, in presence of a polymerization catalyst.

PLASTICIZER. H. A. Bruson (to Röhm and Haas Co.). U. S. 2,156,144, April 25. Plasticizing nitrocellulose or cellulose acetate with a vacuum-distilled air-blown crotonate of a polyhydric alcohol.

MOLDING COMPOUND. E. T. Olson and R. H. Plow (to Northwood Chemical Co.). U. S. 2,156,160, April 25. Treating lignin cellulose with sulphuric acid to form a mixture of lignin (40–95%) and degraded cellulose (5–60%), and compounding the product with a plasticizer to make a thermosetting molding composition.

CASHEW NUT PLASTIC. Jos. N. Kuzmick (to Irvington Varnish and Insulator Co.). U. S. 2,156,431, May 2. Polymerizing cashew nut shell oil with sulphuric acid and condensing with hexamethylenetetramine to a rubbery, millable product.

DYEING MOLDINGS. R. O. Wood (to Dipol Process Co.). U. S. 2,156,442, May 2. A spirit-soluble basic dye for coloring plastics (cast phenolic resins) is dissolved in glycol and a glycol ether in aqueous di- and trisodium phosphate solution.

FELT. J. Kleine and W. Brennecke (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,156,455, May 2. A strong but soft and pliable felt is made by blending the wool, not with rayon but with synthetic (vinyl resin or chlorinated rubber) fibers.

SAFETY GLASS. B. J. Dennison; R. G. Whittemore (to Pittsburgh Plate Glass Co.). U. S. 2,156,680 and 2,156,714, May 2. Applying a polyvinyl acetal interlayer to glass under rolling pressure to expel air bubbles, heating to dry the resin, and applying a second glass plate under heat and rolling pressure; and making bent safety glass by forming the glass and resin assembly in an autoclave, removing from the autoclave and reheating to soften the interlayer, bending to shape and cooling while bent.

COATED PARCHMENT PAPER. E. Gebauer-Fulnegg and E. W. Moffett (to Marbo Patents, Inc.). U. S. 2,156,755, May 2. Coating parchment paper with a flexible film of rubber hydrochloride and a resin such as polycoumarone, ester gum, copal or a phenol-aldehyde resin.

FRICTION FACINGS. K. Wolf and H. Scheuermann (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,156,828, May 2. Bonding agents for friction facings are made of hardened alkyd resins modified with natural resin acids.

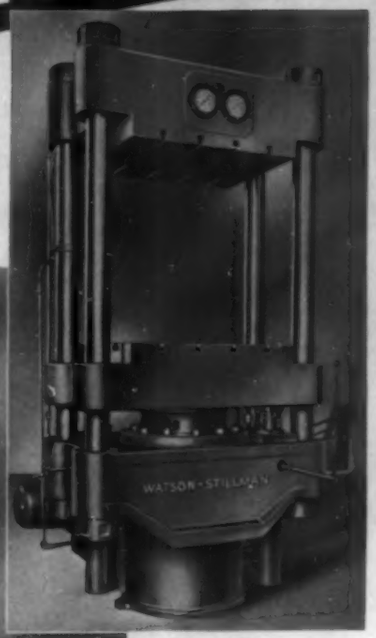
RUBBERY PLASTIC. M. C. Agens (to General Electric Co.) U. S. 2,156,956, May 2. Compounding vinyl chloride resin with an acetylated ricinoleate ester to form a rubber-like product.

FOOD WRAPPER. T. M. Hill (to Aluminum Co. of America). U. S. 2,156,987, May 2. Protecting aluminum foil food wrappers from corrosion by coating the foil with a plasticized vinyl ester resin.

CAST RESIN SHEETS. W. F. Bartoe (to Röhm and Haas Co.). U. S. 2,157,049, May 2. In forming cast sheeting from vinyl resins, the fine surface cracks which commonly appear are avoided by heating the molded sheet, after it is taken from the mold, so that surface strains are released but the sheet is not distorted.

RESIN STABILIZERS. T. F. Carruthers and C. M. Blair (to Carbide and Carbon Chemicals Corp.). U. S. 2,157,068, May 2. Stabilizing light-sensitive vinyl chloride interpolymer resins against light by adding 0.5 to 10% of an aromatic carboxylic acid esterified with a phenol.

PRESSES *for* PLASTICS



450 Ton Semi-Automatic Molding Press. Completely self-contained with fully enclosed hydraulic power unit at rear.

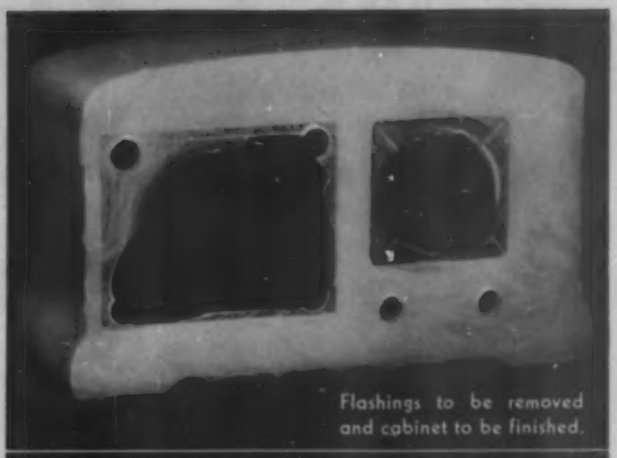
60 Ton Self-Contained Molding Press of the semi-automatic type. Fully enclosed hydraulic power unit.

Watson-Stillman Molding Presses—plain types, semi-automatics, tilting head and angle presses—are all "engineered-for-the-job" by a staff of Engineers thoroughly familiar with every phase of press design and construction.

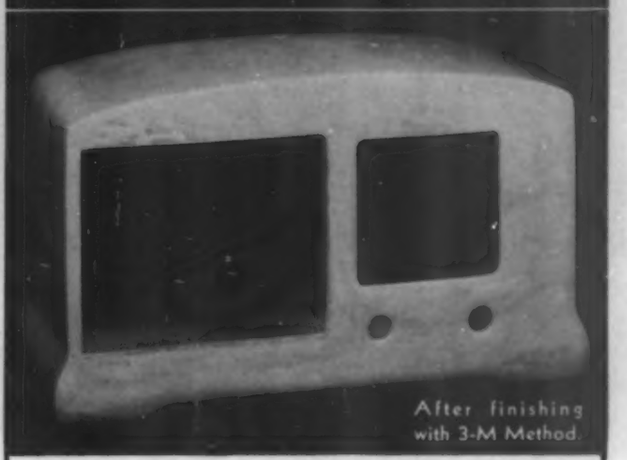
Our long experience qualifies us as experts in providing the exact type of press to do your jobs with greatest efficiency.

For any job of compression or injection molding get in touch with our Engineering Department. The Watson-Stillman Company 118 Aldene Road, Roselle, N. J.

WATSON STILLMAN



Flashings to be removed and cabinet to be finished.



After finishing with 3-M Method.

Try THE 3-M METHOD for Finishing Plastics and Hard Rubber Products

Speed—elimination of fire and dust hazards—a better finish and in a majority of cases cost reductions are a few of the outstanding advantages gained when this method is used.

The 3-M Method, for finishing plastics and hard rubber products, was developed and is made specially for the plastic and hard rubber industry.

Write for our new circular completely explaining this method.

MINNESOTA MINING & MFG. CO.

SAINT PAUL MINNESOTA

The Desire To Serve The Ability To Produce

MINNESOTA MINING & MFG. CO., Dept. MP639
Saint Paul, Minn.

Gentlemen:

Kindly send your circular on finishing plastics.

Company.....

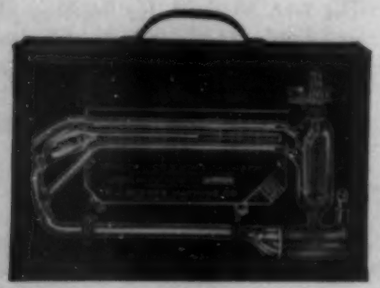
Address.....

City..... State.....

Equipment

THE HACK MACHINE CO., ANNOUNCES THE MULTI-VERSAL machine in which two high-speed auxiliary heads are used in connection with twin turntables to machine more than one cavity in a mold at the same time. The center spindle may be used with either or both of the auxiliary heads permitting the machining of three cavities simultaneously. The machine (pictured) is at work routing out two battery grid molds and the set-up was accomplished in 28 min. which illustrates the speed with which the machine adapts itself to unusual applications. The twin turntables permit angular work on two pieces at the same time. Booklet is available from manufacturer on request.

MILLIVOLTMETER TYPE PYROMETERS, INCLUDING AUTOmatic controllers, temperature recorders, temperature indicators, signalers, and all related equipment for applications involving temperature problems, are supplied by Brown Instrument Company.



QUICKLY READ AND SAFELY PORTABLE, A NEW HIGH-VACuum gage has recently been placed on the market by F. J. Stokes Machine Co. Rugged and compact, it measures 7 in. by 11 in. by 2 in.; weighs only 4½ lbs. with mercury; tubing is extra-heavy and so provided that mercury cannot spill out. Equipped with a swivel bracket for mounting in permanent position, the gage covers the entire range of pressures met with in high vacuum practice and is designed to be rotated rapidly, without danger of breakage, from horizontal (evacuated) position to vertical (reading) position, thus making it possible to take readings quickly and continuously. (Illustrated above.)

THE PARK SALES COMPANY IS INTRODUCING THE LINE OF precision instruments made by P. Roch, celebrated Swiss manufacturer. The line includes vernier calipers with Metric and American graduations; depth gages, heighth gages, gear calipers, universal bevel protractors, etc. All these instruments are made of stainless steel and are reported to have a guaranteed precision of 1/10000. (Shown above.)

A NEW SERIES OF "SELECT-O-SPEED" TRANSMISSIONS WITH hand wheel control is announced by the Ideal Commutator Dresser Co. These new models supplement the standard line from fractional to 7½ H.P. capacity that are equipped with lever type control. The hand wheel is recommended where finer speed adjustments and smaller increments of speed are necessary. By turning the wheel only a partial turn it is easy to change the speed only a few revolutions per minute.

UTILIZING A CYCLONIC PRINCIPLE OF COMBUSTION AND heat transfer said to be unique, General Furnaces Corp., have announced a new line of "Cyclotherm" heating boilers with sizes ranging from 25 H. P. to 150 H. P. Specifications of units indicate an unusually high rate of heat absorption, the units functioning at a rate far in excess of conventional boilers. This permits units to be constructed with less weight per horsepower than can otherwise be done. High operating efficiency is claimed in addition to economy of operation.

PLASTIC PREHEATING OVEN, RECENTLY BUILT BY THE DESpatch Oven Co., embodies the features of forced draft, positive horizontal flow air circulation and automatic temperature control, at any heat from 140 deg. to 260 deg. F. This unit (pictured) has six sections with shelves, each 12 in. wide, 12 in. long and 3 in. high, and is designed for preheating preforms that have been placed in an open wire container. Portable, the unit can be plugged into practically any 110 volt socket, or can be arranged for 220 volt, if desired.

Publications

Write for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices.

Chemical Industries, 1939

edited by D. M. Newitt

Published by Chemical Publishing Co., 148 Lafayette St., N. Y.
Price $4.00 **461 pages**

This is a catalog of English manufacturers and suppliers of chemical raw materials, products, plant and equipment, amply supplemented by descriptive and tabular information of ready reference character. The book is divided into ten sections, each one dealing with some particular phase of plant construction or manufacturing process. The information is intended to indicate to prospective purchasers the type of plant best suited to carrying out any particular operation. We would reasonably expect to find some mention of the various corrosion-resistant organic plastics in the chapter on "Materials of Construction Used in Chemical Industry," but were disappointed in this respect. G. M. K.

The Knack of Selling Yourself

by James T. Mangan

Published by The Dartnell Corp., Chicago, Illinois
Price $2.50 **234 pages**

If you earn more than twenty thousand a year, you'll not need to read this book. You'll have learned the knack without it. But if you have anything to sell; if you are ever called upon to make a speech; or if you have to write anything for publication; you'll find that a few minutes with author Mangan will put a whale of a measure of enthusiasm into the void that confronts many of us when we attempt any of these things. Selling ourselves constitutes life's number one problem. How to do it in the easiest and simplest way is well outlined in this volume of pleasant and profitable reading. A swell book to give to salesmen and junior executives in any organization. E. F. L.

Dictionary of Scientific Terms

by C. M. Beadnell, C.B., F.Z.H.

Published by Chemical Publishing Co., 148 Lafayette St., N. Y.
Price $3.00 **235 pages**

This is not a dictionary in the ordinary sense but is a book which describes such things as hormones, vitamins, wave-lengths, protons, atoms, heavy hydrogen, heavy water, heavy ice; chemical elements that are changeable into other elements; elements, on the one hand, that have had a span of existence of millions of years, and on the other hand, that varnish in a few hours, in a minute or two, or it may be, in a fractional second after their birth.

Arranged in true dictionary fashion, descriptions are brief and to the point, yet are sufficiently detailed to enable the layman or laboratory worker to determine the exact definition of the terms with which he must essentially become familiar in his daily work or reading. E. F. L.

A BULLETIN FROM THE AMERICAN BRASS COMPANY DEscribes the products of its American Metal Hose Branch, Waterbury, Conn., manufacturers of American Flexible Metal Hose and Tubing. This tubing is used for conveying liquids and gases under high pressures and temperatures, carrying steam and cold water, connecting moving parts of machinery and absorbing destructive vibration. It is made from any workable metal and in many styles.

THE BRITISH XYLONITE CO., LTD., HAS PUBLISHED A BOOKlet describing the history of the company since its formation in 1877. In its pages are included descriptions of the firm's products, plants and methods of manufacture, all fully illustrated.

THE ASSOCIATION OF CONSULTING CHEMISTS AND CHEMIcal Engineers, Inc., 50 East 41st Street, New York City, has recently published a Directory of Association Members which is available to the plastics trade. The directory is designed to help all who need chemical advice or service and the consultants and the directors of analytical and testing laboratories, who are members of the Association, are listed together with the type of service they are prepared to render.

MECHANIC'S TOOLS, OPTICAL INSPECTION TOOLS, GEAR testing equipment, and precision machine tools, together with machinery for instrument making, automatic turning lathes, pivot burnishing machines, opticians' turret lathes, jig borers, etc., are described and pictured in a new catalog issued by George Scherr Co., Inc., 128 Lafayette Street, New York, N. Y. Such items as hand tachometers, speed indicators, binocular microscopes, measuring and comparison microscopes, toolmakers' microscopes, profile projectors, bore inspection telescopes, automatic saw sharpeners, gear testers and other products are described in detail in this spiral bound book.

THE LOUIS ALLIS CO., MILWAUKEE, WIS., HAS RELEASED A bulletin which deals with its new line of A. C. and D. C. Explosion Proof motors. General operating information and the principal construction features are briefly analyzed and illustrated, showing the principal safety factors, streamline design and operating conveniences.

THE CHICAGO METAL HOSE CORP., MAYWOOD, ILL., HAS published a 38-page booklet describing and illustrating Rex-Weld and Rex-Tube flexible metal hose manufactured by the firm. Detailed instructions on the methods of fitting the tubing and sizes and specifications of the various types available are given. In addition a large number of photographs and diagrams showing the applications of the hose to different conditions and equipment are included.

A 164-PAGE STUDY, KNOWN AS "TRADE PROMOTION SERIES No. 189 Synthetic Organic Chemicals—World Developments and Foreign Markets" was recently placed on sale by the Superintendent of Documents, Washington, D. C., at 20¢ per copy. It is also on sale by the District Offices of the Bureau of Foreign and Domestic Commerce.

Data published in this bulletin have been obtained from reports submitted by representatives of the Departments of Commerce and State stationed in foreign countries. Some of the reports were so voluminous and detailed that it is impossible to present the full data submitted in the compass of a small bulletin. Additional information is, in most cases, available upon application to the Bureau.

THE CHARACTERISTICS, USES, AND ADVANTAGES OF RESISTOflex PVA are detailed in a folder issued by Resistoflex Corp., 370 Lexington Avenue, New York City. This synthetic resin material is an entirely new product development offered chiefly in the form of flexible tubing, and is claimed to be unaffected by oils and organic solvents. Its makers announce that it will soon be obtainable as gaskets, washers, packing, diaphragms and sheet material.

"FARMWARD MARCH," IS A CHEMURGIC BOOK BY DR. William J. Hale, originator of the word "chemurgy" and recipient of the Pioneer Cup for 1938, published by The Stratford Co., printers of "The Farm Chemurgic" and "Prosperity Beckons," by Dr. Hale.

A NEW 36-PAGE CATOLOG OF TECHNICAL BOOKS HAS BEEN issued by the Chemical Publishing Co., Inc., New York City. It covers domestic and imported books on chemistry, physics, mathematics, medicine, metallurgy, machinery, engineering, biology, general science, business, manufacturing, formularies and technical dictionaries. A copy will be sent by the publishers to anyone interested on receipt of stamps to cover postage.

A REVISED SIX-PAGE, TWO-COLOR BULLETIN ON PIPE SUPports, Saddle Plates, Pipe Alignment Guides and Pipe Anchors for steam or hot water lines may be obtained by addressing the American District Steam Co., North Tonawanda, N. Y., manufacturers of expansion joints and other steam equipment.

Above—Knobs and handles of the new line of Revere Ware cooking utensils of stainless steel with copper clad bottoms are molded from heat resistant Bakelite phenolic for Revere Copper and Brass, Inc.

Below—Revolutionary new design pistol-grip handle gives perfect balance; can't slip or twist. Note solid ring in handle. Cover knobs are of easy-grip design, welded to covers.

Smartly designed

PLASTICS LIFT THE LID ON PROFITS

Whether it's a heat resistant knob for kitchenware, a radio cabinet, an electric switch plate or an essential part of an electrical appliance, the flexibility of design afforded by molded plastics is a wedge that will pry up the lid on profit.

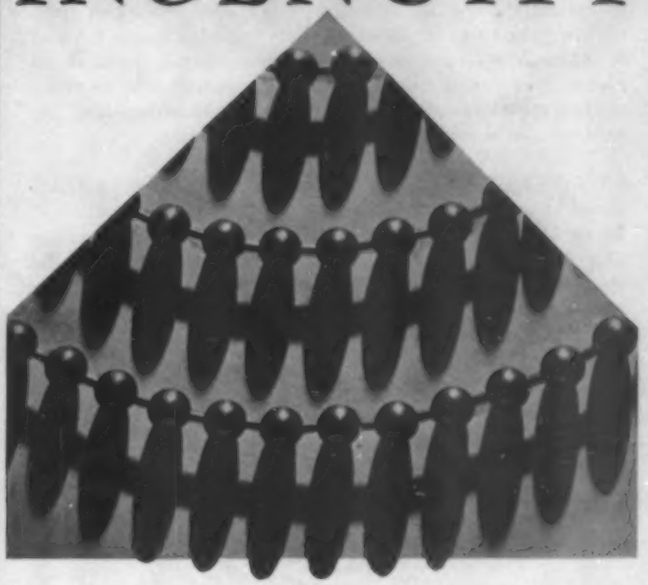
And when you place that molded plastic order with Auburn . . . you can be sure that your job is in the hands of workmen who can take full advantage of that flexibility. Back of their knowledge of plastics and molding is more than 60 years' experience. Added to it, are the numerous rigid inspections that insure the quality and accuracy of every piece . . . plus efficient handling that, more often than not, means a sharp reduction in cost with no cut in quality.

Let an Auburn engineer work with you on your next molded plastic job.

Established 1876

MOLDED PLASTICS DIVISION OF
AUBURN BUTTON WORKS, Inc.
AUBURN, N. Y.

INGENUITY



Added distinction and efficiency are possible with many products by the use of BEAD CHAIN* either as a decorative feature or to replace ordinary chain or cord—for the smooth round beads will not kink nor tangle.

BEAD CHAIN*

It may be had in bead diameter sizes from 3/32" to 3/8", with couplings and attachments to serve specific needs. BEAD CHAIN* is regularly made of many metals, including brass, nickel silver, aluminum and Monel, and can be finished to harmonize perfectly with your product.

BEAD CHAIN
ESTABLISHED 1914
Trade Mark Reg. U.S. Pat. Off.

With our 25 years' experience we are prepared to cooperate thoroughly with designers and manufacturers in the development of practical uses of BEAD CHAIN* with their products.

THE BEAD CHAIN MANUFACTURING CO.
*Reg. U. S. Pat. Off. 60 MT. GROVE ST. BRIDGEPORT, CONN.

News

A NEW CASTING RESIN WHICH, WITH THE AID OF A PREpared accelerator, will harden in from 24 to 48 hours without heat or pressure is announced by the Marblette Corp., Long Island City. Clear transparent, the new resin is designated as Marblette Quick-set and is reported to be a superior adhesive for many purposes because it "sets" or hardens from its own acceleration without the necessity of air exposure. As a casting resin, Quick-set holds great promise for rubber molding operations either on an experimental or production basis. The resin may also be used for impregnation and lamination.

OVER TWENTY SEPARATE TECHNICAL SESSIONS WILL BE INcluded at the 1939 (Forty-Second) Annual Meeting of the American Society for Testing Materials to be held at Atlantic City, June 26 to June 30, to provide for presentation of numerous technical papers and reports, round-table discussions and symposiums. Throughout the week, there will be in progress the Fifth Exhibit of Testing Apparatus and Related Equipment, and also the Society's Photographic Display, the theme of which this year is "Testing and Research in Engineering Materials." The May A. S. T. M. Bulletin includes the Provisional program for the meeting and gives synopses of papers and reports to be presented.

E. J. LUSTER, FORMERLY PRESIDENT OF THE CATALIN CORP., who has spent the past two and a half years in England organizing Catalin, Ltd., has finished his mission there and has returned to the United States for a well-earned rest. His plans for the future are unannounced.

WITH COMPLETE MANUFACTURING AND ENGINEERING facilities at Mount Gilead, Ohio, Hydro-Powers Systems, Inc., has recently been organized for the manufacture and further development of hydraulic machine drives and their component parts—radial pumps, gear pumps, valves and controls. The new company is the outgrowth of a broad experience in the successful development and application of hydraulic drives to H-P-M Fastraverse Presses during the past fifteen years—the replacement of water pressure accumulator systems on other makes of presses—and to numerous other types of machinery where the hydraulic drive works to advantage.

LATE IN APRIL TWO HUNDRED SEVENTY-SEVEN OLD TIMERS of Bakelite Corp., plastic materials manufacturer, held their sixth annual reunion at the Flagship on Route 29, near Union, N. J. "BOTA," the Bakelite Old Timers Association, was founded in 1934 by a group of employees who felt that they should get together once a year for an evening of fun to celebrate their years of fellowship with the organization. Their only requirement for membership is an employment record with Bakelite Corporation of ten years or more. This year six Bakelite men became eligible for the twenty-five year service award, a handsomely engraved gold watch which is presented by the corporation to those employees who have attained a quarter of a century of service. They are as follows: Lawrence V. Redman, Founder of the former Redmanol Chemical Products Co., now Vice-President of Bakelite Corp. at Bloomfield, Frank P. Brock, Research Chemist at Bloomfield, Archie J. Weith, Director of Research & Development at Bloomfield, Thomas J. Major, Purchasing Agent and Traffic Manager at New York Office, Robert A. Brenneck, Sales Engineer in charge of Chicago office, Frank Mystowski of Research Laboratories in Bloomfield. The number of members in the twenty-five year group has now reached a total of eighteen, while the ten-year group boasts of two hundred fifty-nine members.

PLASTIC INLAYS, INC., SUMMIT, N. J., ANNOUNCE THE following changes in personnel: M. Guy Sypher, in charge of production; B. E. Wilson, in charge of the Detroit office; Thomas Wainman, Chief Service Engineer. Thomas R. Sterck is no longer connected with the company. I. P. Scott will continue as sales representative at Detroit and their new Sales Manager is William B. Greenlaw.

NEW SOCKET SCREW DRAFTING ROOM REVOLVING CHART has been prepared for distribution by Parker-Kalon Corp., 200 Varick St., N. Y. This chart (illustrated above) condenses in a form suitable for ready reference, a large amount of data essential to users of socket screws. It is available without charge on request from any engineer, draftsman or production official.

THE ANNUAL CONFERENCE OF THE NATIONAL INDUSTRIAL Advertisers Association, Inc., will be held in New York, September 20, 21 and 22, at the Hotel New Yorker under the sponsorship of the Association's New York Chapter, the Technical Publicity Association. The New Jersey Chapter, Industrial Marketers, N. J., will be co-hosts.

Edward Phoenix, Johns-Manville Co., President of the New York Chapter, is Chairman of the General Conference Committee. Members of this Committee are: R. Barbour, Bakelite Corp.; K. Lydiard, Fred Glen Small; C. Neighbors, Babcock and Wilcox Co.; R. Wensley, G. M. Basford Co.; R. Davison, New Jersey Zinc Co.; C. McDonough, Combustion Engineering Co., Inc.; K. Bailey, Thos. A. Edison, Inc.; and W. Cather, Babcock and Wilcox Co.

WE ARE INDEED SORRY TO LEARN OF THE DEATH ON MAY 17th of Richmond Rochester, vice-president and general manager for the past six years of Tech-Art Plastics Co., Long Island City, N. Y. A graduate of Massachusetts Institute of Technology, and of a Berlin technological institution, Mr. Rochester formerly headed Rocamco, Inc., camera manufacturer. He was a member of the employment relations committee of the National Association of Manufacturers and belonged to the Society of the Plastics Industry.

THE ADDITION OF A LACQUER RESEARCH LABORATORY AND technical service department to its Lacquer Division at Dunellen, N. Je, has been announced by the National Adhesives Corp., N. Y. The technical staff of this division is also being increased to facilitate additional research and development work. An extension is being erected, adjoining the separate building now occupied by the Lacquer Division, to accommodate the new laboratory. The present building will be devoted exclusively to the manufacture of non-aqueous adhesives for transparent sheetings, coating lacquers for textile printing, thermoplastic adhesives, and general moisture-proof adhesives.

BELMONT MOLDED PLASTICS, INC., CUSTOM MOLDERS, HAVE moved factory and offices into spacious new daylight quarters in the Pugh Building at 400 Pike Street, Cincinnati. Entirely new equipment has been installed including latest and modern developments in injection molding presses, which will greatly widen their scope of operations. A. W. Schoneberger, a pioneer in the injection molding industry, is president of the company.

THE PROCESS OF LAMINATING PAPER WITH TRANSPARENT cellulose acetate sheeting, developed several years ago as a preservative measure by the National Bureau of Standards, has come into considerable use. The first application of the process in the documentary field was by the National Archives of the United States. It was chosen as

GENERAL VON BLUECHER ARRIVED ON TIME

This doughty Prussian general attained great fame in the Napoleonic wars. The incident for which he became best known was his arrival on the field at the battle of Waterloo in time to clinch Wellington's victory and complete the rout of the French.

GENERAL INDUSTRIES

delivers your molded plastics on time . . . .

Plan with us. Tell us when you want your molded plastic parts and, depend on it, they will be there—on time. And thereafter, shipments from General Industries will arrive regularly as specified to meet your production requirements. General Industries has been made the principal supplier to many a user of molded plastics on this account.

If you want to be freed from worries over delayed deliveries, look to General Industries to supply your molded plastics requirements. You can rely on high quality, fine finish, accuracy, and costs which spell distinct savings.

Send us blue prints, specifications and indicate your delivery requirements.

GENERAL INDUSTRIES CO.
Molded Plastics Division
OLIVE & TAYLOR STREETS, ELYRIA, OHIO

Mr. Injection Molder:
Do You

Realize

Why it is possible to mold this on the 29-B Grotelite Injection Press

Wt.	10 oz.	Leader Dimensions	0.10" x 7/16"
Area	98 sq. in.	Molded Density	1.31
Travel	230 in.	Sink Marks	None
Nozzle Orifice	0.150"	Laminated Structure	None
Leaders	One	Bonding	Excellent

It is possible, because with the Grotelite 29-B Injection Press

Heating is uniform and capacity ample without overheating.

Temperature control is delicately correct.

Mold Locking is positive with the wedge lock.

Injection is uniform, using ONE pressure from the start of injection piston travel.

Speed of injection is controllable up to 200 inches per minute.

GROTELITE CO., Inc.
BELLEVUE · · KENTUCKY

the best means, and the only feasible means, of laminating the vast amount of documents received by them which require such treatment. The sheeting is applied by means of heat and pressure, no adhesive being used, and a homogeneous unit is obtained as the cellulose sheeting is actually forced into the pores of the paper. The acetate sheeting used is very stable, has high transparency and strength, and is very thin.

A RESEARCH CONFERENCE ON "RESINOUS POLYMERS" HAS been arranged for the week of July 10 at Gibson Island, Maryland, by the Chemistry Section of the American Association for the Advancement of Science. Dr. Leo H. Baekeland is to be Honorary Chairman with Dr. H. L. Bender as Chairman. The scheduled papers will outline the fields of research and direct attention to unsolved problems, but the real feature of these meetings is the unlimited informal discussions which follow each paper. The program will also permit ample time for enjoyment of the many recreational features which the Island affords. Further information regarding the conference can be obtained from Dr. Neil E. Gordon, Central College, Fayette, Missouri. The scheduled speakers and titles of their papers are as follows:

July 10. L. H. Baekeland, "Introduction"
Howard L. Bender, "The Physical Viewpoint of Resinous Particles as to Size and Linkage"
Tom Midgley, Leader of discussion of preceding paper

July 11. R. H. Kienle, "The Infusible Resinous State"
S. S. Kistler, "Conditions for Infusibility"

July 12. S. D. Douglas, "The Resinous Vinyl Compounds"
Ivy Allen, "Polystyrene"

July 13. C. S. Marvel, "The Structure of Some Vinyl Polymers"
R. B. Barnes, "Spectroscopy and Resin Structure"

July 14. G. M. Kline, "Electronic Structure and the Behavior of Cellulose Compounds"
P. J. Flory, "Viscosity and Constitution of High Molecular Weight Substances"

TO SECURE ADDITIONAL SPACE TENNESSEE EASTMAN CORP.'S New York Tenite sales representatives, William L. Searles, John P. Tokarz, and John H. Deer, have moved their offices to Suite 3600, 10 East 40th St., N. Y. Telephone and teletype numbers remain the same.

DIRECTORY LISTINGS FOR THE OCTOBER ISSUE OF MODERN PLASTICS should be mailed to the Editor before July First. Special listing blanks are provided and will be mailed without cost or obligation upon request.

ANNOUNCEMENT HAS BEEN MADE BY THE BARRETT CO., a subsidiary of Allied Chemical & Dye Corp., that it will immediately construct a new unit at its Frankford, Pa., plant for production of synthetic phenol. Barrett has been a supplier of phenol to the chemical industry for over 60 years and to the plastics industry since the establishment of the latter in this country.

IMPERVIUM, A NEW SYNTHETIC COATING FOR METAL, HAS been announced by Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit. It is reported to defy acids, alkalis, and oils. By an unusual combination of synthetic resins, chemists have developed this material which is claimed to retain a rubbery flexibility over a long period of time.

CONAL KITCHEN IS NOW LOCATED IN THE NEW YORK OFFICE of General Plastics, Inc., 250 Park Ave. Mr. Kitchen has been with the company nine years, the last two of which were spent in Chicago.

TO FURTHER SAFE GUARD ACIDS AGAINST CONTAMINATION from closure substitution, Acid-Tite bottles, used by the J. T. Baker Chemical Co., Phillipsburg, N. J., are now identified by different colored closures that match the labels. These transparent, molded plastic acid-resisting closures are leak-proof and all sealed with a tamper-proof band. Color schemes are: red-Nitric Acid, blue-Hydrochloric Acid, white-Aqua Ammonia, yellow-Sulfuric Acid.

REYNOLDS MOLDED PLASTICS, A DIVISION OF REYNOLDS Spring Co., Jackson, Michigan, has appointed Robert R. Wilson as sales representative for the Ohio territory with an office at 601 Hanna Building, Cleveland. Production and shipping operations for this territory will be handled by the new plant at Cambridge, Ohio.

Golf and good fellowship at the meeting of the Society of the Plastics Industry held May 14–16, at the Westchester Country Club, Rye, N. Y. Photos by Walter Landauer. (Story on page 31)

EVERYTHING'S UNDER CONTROL

(*Continued from page 27*) can be used there is a resultful advantage to both manufacturer and consumer—longer life and less factory service.

One manufacturer just announced a new control unit, a combination time and temperature control, employing plastics for a fairly large internal housing. By so doing it was possible to obtain an almost idealistic design both from the engineers' and users' standpoint. The complete unit is especially compact. The molded housing has more than two dozen holes of five different sizes, some in tapered bosses, some countersunk with long taper, others straight through. Several types of ribs, gussets and fillets, some for reinforcing, others for alignment, flat, round or pyramid shapes—all are molded-in. Fourteen brass inserts, wiring and connection lettering and figures are molded-in, too. All in all, it's a typical example of the many machining and assembly operations which can be eliminated through the use of molded plastics.

In the heavier duty field of relays, circuit breakers, and the like, plastics are more generally used for various internal parts such as switch arms, toggles, sockets, plates, bobbins, bars, breakers strips. Exemplifying such uses is the illustration (below) of parts from several types of solenoid motor controls—overload relays, assemblies and push-button stations. Rigidity of molded-in metal parts is demonstrated in the large and small copper to copper contact bars, some with three, others with four contacts on the same bar. These contacts are mounted over copper cups containing springs of high or low tension employing a constant force on the insert in either case. Yet the inserts are so solidly anchored in the plastic bar they do not give way. At the same time, the bar serves as an insulator. The push buttons themselves are of molded plastic in the standard color code, lettering being recessed right in the buttons whether concave, flat or convex. In thermal relays, where the heat becomes great enough to melt the solder, plastics are used because they are unaffected by such heat and further provide the advantage of being non-heat-conducting. Phenolic plastics serve best because they are self-insulating, will not swell from moisture nor crack from heat. Above all, they mean economy in production—because of the intricacy of shapes which molded parts can take, in general no machining operations are necessary and almost no finishing costs are involved. All these mean simplification of design and assembly and they may be the means of incorporating advanced design into the units.

The advantages plastic materials offer do not stop in the engineering department. They continue on into the sales department, becoming sharpshooting ammunition in the hands of these men on the consumer firing line.

Overload relays, assemblies, push-button stations and various internal mechanisms used in time and temperature controls are manufactured of phenolics chiefly because of the material's self-insulating, non-heat-conducting properties and resistance to moisture. Molded parts shown below are all of Durez, made by Allen-Bradley Company

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S. S. PANAMA

(*Continued from page* 32) these modern ships actually need no styling to perform such service. Cargo rides below decks and cares nothing about modern interiors. The management, however, alert to the popular trend of tropical cruises and aware of the extra revenue available from those who are curious to visit the Canal Zone, has gone out of its way to provide comfortable and attractive public and private rooms in which to make the trip. And they have built these ships according to the new specifications adopted by the Bureau of Marine Inspection and Navigation following the Morro Castle and Mohawk disasters, to make them safe at sea.

In the club rooms, for instance, doors are of stainless steel; tables combine tops of laminated plastics and aluminum; glass is used functionally as well as decoratively. All the furniture in staterooms and public spaces is fireproof and of special design. Upholstered pieces make use of sponge rubber that has been fireproofed.

Throughout the ship the basic structural scheme has been imaginatively used as part of the decorative treatment. This is characteristic of the approach of the industrial designer to problems of this kind. To Mr. Loewy, planning the interior of a ship is not a matter of "interior decoration," but of *design*. It is therefore interesting to note the manner in which the architectural and decorative themes have been coordinated to achieve simple, unified, modern effects.

In the lounge, for example, where ceilings are low, a soft cool green gives a feeling of greater proportions; in the main hall which is two-deck height, the beams are accented by covering the area between with metallic paper. Additional interest is provided by making use of indirect laminated translucent plastic lighting fixtures suspended from the two main fore and aft beams. The treatment accorded the airports in the club room is novel. Accented with stainless steel and given unusual color treatment, they have been recessed in such a way as to give a flush modern effect.

Wall and ceiling surfaces are treated in new and interesting ways. Oxidized gold paper, leather, wood veneers, flesh-tinted mirrors, translucent glass, silver leaf, baked enamel and laminated surfaces of paint and paper vary the decorative effects.

Special attention has been paid to the matter of illumination. In some cases it becomes part of the ship's architecture and we find troughs of indirect light, brilliant coves and spotlight effects. Fixtures are effective in

Fig. 5 shows another view of the Main Hall with its molded Plaskon lighting fixtures and Insurok table lamps which contribute so much to the decorative theme. Staterooms (Fig. 6) are bright and airy with a cheerfulness that has not been sacrificed by the fireproof construction of walls and furnishings. Each of four staterooms enters into a semi-private veranda (Fig. 7) which provides an intimate corner for group gatherings. Tables in staterooms, verandas and all public rooms are laminated Formica in white, coral or black

their restrained and simple design and plastics have been intelligently combined with aluminum and glass. Half-round molded shades of urea plastic fit snugly to the walls in most of the public areas and corridors as well.

Table lamps are equipped with translucent laminated urea plastics while floor lamps are topped by glass reflectors. Trough lights over stairway to the lounge are made in sections of glass separated by clear plastics to relieve the design. Besides lighting the stairway, these fixtures spotlight the arched cove above (Fig. 1). In this area also, there are triple bowls of molded urea fashioned into a new type of lighting fixture. These same bowls as single units are used to illuminate the staterooms and dining room.

White laminated urea, framed with aluminum, is employed for table tops throughout the lounge, club room and verandas. But black laminated phenolic plastic has been chosen to serve as table and dresser tops in individual rooms. All table tops as well as the bar top in the club room are blisterproof laminated material.

The outdoor deck cafe is typical of the pleasant spots one finds everywhere for congenial gatherings, dancing and entertainment, with white metal furniture, covered with blue-green waterproof fabrics and circular tables with coral plastic tops.

Even at the swimming pool one finds blue and coral outdoor tables, beach umbrellas with white and corn colored metal chairs that lend brightness and charm.

These little adventures of plastics in marine and aircraft construction should encourage architects, decorators and designers who build for permanence on shore to investigate their intrinsic worth and become better acquainted with their possibilities as modern structural and decorative materials.

YANKEE CLIPPER

(*Continued from page 25*) 1/8 in. thick, of ultra-transparent moisture-proof acrylic resin. Under the fabric of the walls in certain areas, there are reinforcing sheets of laminated phenolic which were perforated in order to reduce noise.

Laminated phenolic, to match the wall fabrics, was specified for the tops of dressing tables and wash basins. Hot and cold water faucet handles, soap dispenser knobs, waste control knobs and dressing table drawer pulls are of appropriately colored cast resin.

To secure proper diffusion of light throughout the interior of the plane, translucent compartment dome lights were specified. Night light fixtures in door soffits and mirror lights are of cellulose acetate. And during the day sunlight streams in through windows made of 3/16 in. acrylic sheet. This same material is used also in the navigator's turret. Accordion pleated window shades, making their first appearance in a plane, furnish a smart modern touch, giving the effect of a venetian blind.

Transparent illuminated signs in the wall of each compartment of the ship notify passengers when the plane is due to land, and flashers are located in each door to summon the steward. Composited in the transparencies of the flasher signs is a sheet of polyvinyl acetal resin. The ventilator control knobs are of plastic to save weight and to match wall colors.

Probably not seen by the passengers, but doing an equally effective job are plastic gasoline tank stick gages and various knobs in the instrument panel and control room. Laminated material is used for control pulleys, fairleads, spacers and bushings, as well as for reinforcement behind the wall fabric in certain areas.

Closely related to plastics are the paints and lacquers used. The huge hull required 112 pounds of paint and 30 pounds more were used in finishing parts visible to the eye in the interior.

The Yankee Clipper is one of a fleet of six being built for Pan American Airways. Four have already been completed and the other two are well on the way. Flight schedules have not yet been definitely decided upon, but it is expected that regular transatlantic service will soon be an accomplished fact. Taking the air in one of these super-liners is a treat to anticipate.

PLASTICS SCULPTURE COMPETITION

(*Continued from page 29*) sketches were received as well from architects, industrial designers, engineers, teachers, a lawyer, a chemist and a medical student.

Fifteen hundred dollars in prizes were distributed by Röhm & Haas, to the five sculptors whose work is illustrated. The jury was selected by the Museum of Modern Art comprising Miss Katherine Dreier, Messrs. Robert Laurent and James Johnson Sweeney. Their report follows:

Jurors' Report

No attempt was made at the first meeting to award specific prizes. Five sketches were selected for execution in Plexiglas and Honorable Mention was given to the sketches submitted by Harold Barnett, New York, and Lawrence Roberts of Pasadena, California.

Entries were eliminated for one or more of the following reasons:

1—Difficulty of execution in Plexiglas.
2—Failure of the artist to consider standard sizes in which the material is available.
3—Failure to exploit the full possibilities of the material as a sculptor's medium.
4—Failure to carry the proportions of the sketch into the model where a model accompanied the drawing; conversely, the presence of a model sometimes clarified the drawing.
5—A good idea not fully realized.
6—In the case of some abstractions, too reminiscent of works of well known European abstractionists.

At its second meeting on April 24th, the jury considered the five submissions which had been executed in full size. These five had been selected at the preliminary meeting from among the 250 entries.

First prize was awarded to Alexander Calder for the original conception of his design. It was felt that his

idea conveyed a distinct sense of artistic power expressed in terms of his medium, which had been fully realized.

Second prize was awarded to Herbert Matter for the originality of his design and for its charm. It was felt however, that Mr. Matter's entry lacked the oneness and power of the conception and execution of Mr. Calder's design.

Werner Drewes received third prize for a design which, although it exploited fully the possibilities of the material as a sculptor's medium, had not carried into execution the fineness of conception which had been in his original model.

Fourth prize was awarded to C. K. Castaing for his beautiful design, which, however, was two-dimensional instead of three.

Fifth prize was awarded to Xanti Schawinsky. Although his entry evidenced fine craftsmanship, it was felt that it did not fulfill the artistic purpose of the competition to the fullest possible advantage.

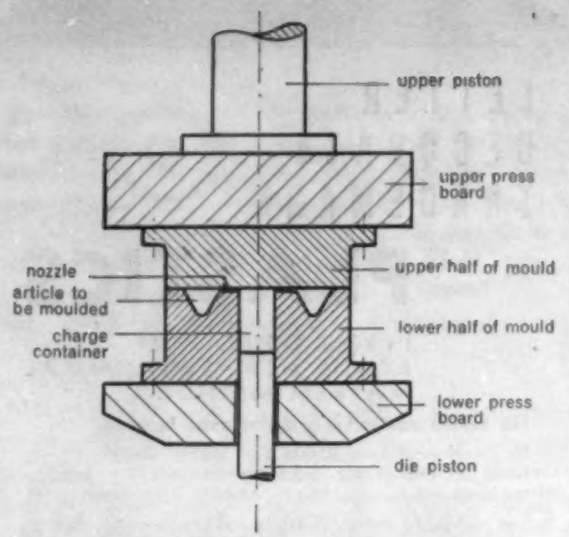


Diagram shows cross section of Hyjector Die Press

INJECTION MOLDING THERMOSETTING RESINS

(*Continued from page 42*) process or molding cycle is considerably speeded. Parts with thick walls can be cured in a fraction of the time required in ordinary compression methods. At the same time, as the material flows into the mold in a liquid and highly heated condition, the hardening process is greatly improved and thick-walled parts are turned out in a much better quality. It is well known that artificial resin is a bad heat conductor, and for this reason, thick-walled parts molded by compression methods, are seldom produced in a homogenous consistency because the drop of temperature in the thick walls is too great.

It is claimed that articles with thin walls, or walls of varying thickness can be more successfully produced by injection because when using compression methods, the thin-walled parts are overcured, while the thick walls are likely to remain insufficiently hardened. This new press is reported to successfully meet all practical requirements for the practical application of the injection process to thermosetting resins.

As may be seen from the sketch, the mold is divided horizontally. In the lower half is the charge chamber, while the shaping molds (connected with it through nozzles) are concentrically arranged around this space. The die piston actuated by the lower piston of the press, operates in the charge chamber, while the upper half of the mold, which closes the complete mold, is controlled by the upper press piston.

The upper and lower pistons exert pressures which are adjusted relatively to each other by experience, so that an absolutely tight seal is assured. The molding material is placed in the charge chamber and the mold is closed by operating the control of the upper press piston. Then the die piston is operated by means of a controlling device. It is exposed to pressure for the required period, and then withdrawn upon completion of the injection process. When the mold has been opened by means of the upper piston, the finished part is taken out, using the die piston as an ejector if necessary. The nozzles cannot become clogged because they are easily accessible after opening the press and can be conveniently cleaned.

Ordinary compression molding can be accomplished with the press when desired and the lower piston may be used as a hydraulic ejector.

WHERE ACCURACY IS PARAMOUNT

(*Continued from page 30*)

Another very tricky job was designing the mold for the flexible top member that slides in after the films are inserted and rests gently against their tops. This part had to have a spring tension outward against the groove in the tank wall sufficient to hold it in place against any surge of the liquid solution which might occur and yet be movable by comparatively slight hand pressure.

Slots and slides had to be designed and executed in such a manner that warpage did not exist, for the slightest warpage or displacement of the film slots might prevent proper insertion of the films in the developer and fail to bring about their definite separation while in the developing tank.

Furthermore, all wall thicknesses were engineered so that dependable rigidity would be maintained throughout the useful life of the tank. A point which is sometimes sacrificed through the desire of the manufacturer to cut costs and which almost invariably defeats the purpose for which plastics were chosen originally.

In short, absolute precision and accuracy were necessary and these characteristics were supplied through careful designing and the use of phenolic plastics.

When the company introduced this new film developing tank, it not only won an immediate market at a higher price than competition, but also increased sales of their developing chemical!

CLASSIFICATION AND GENETICS OF ORGANIC PLASTICS

(*Continued from page 48*) compositions are used particularly for articles in which color and appearance are important, such as radio and instrument housings. The fact that they are insoluble, infusible, odorless, tasteless, and generally chemically inert has made possible their successful use for bottle closures and light weight tableware, premium items, and automobile fixtures. The urea-formaldehyde resins have also been introduced into the laminating field in recent years in order to take advantage of their many stable colors. For this purpose thiourea, which has an atom of sulfur in place of the oxygen atom in urea, is employed. The use of the thiourea improves their water-resistance.

3. *Hydroxy-Carboxylic Resins.* The hydroxy-carboxylic type of synthetic resin includes a wide variety of materials produced by the esterification of polybasic acids with polyhydric alcohols. They are frequently called alkyd resins (from *alkyl-acid*). Their principal use is as the resinous constituent of varnishes and lacquers, but they rank second in volume of production in the synthetic resin industry. Phthalic anhydride and glycerol are the primary raw materials employed in their manufacture, from which the name "Glyptal" was adopted as a trade name for the resins by one manufacturer. Other acids which are added to the reaction mixture to convey special properties, such as oil solubility and flexibility, are oleic, abietic (or rosin), adipic, and sebacic. The polyhydric alcohols which may be employed separately or in admixture with glycerol or polyglycerol include ethylene glycol, diethylene glycol, sorbitol, and mannitol. A recent variation in the formulation of these resins involves the combination of maleic anhydride with terpenes, followed by esterification of the acid groups with glycerol or other hydroxy compounds. If compounds with conjugated double bonds are used, the resinification may involve both esterification and polymerization.

When the reactants are limited to dihydric alcohols and dicarboxylic acids, the resulting resin is permanently thermoplastic. If one or more of the reactants has more than two active groups, the possibility of the formation of three-dimensional molecules exists and the resin can be converted to an infusible state. However, the thermal hardening of the alkyds is a slow process and the use of these resins for molding purposes in competition with the fast curing phenolic and amino resins has not become commercially feasible. It has been observed that under normal conditions of production the limit of condensation is a resin with a molecular weight of 3000.

Varnishes and enamels made from alkyd resins modified by the addition of drying oil to the reaction mixture may be either air-drying or baking types. These finishes are characterized by rapidity of drying, good durability outdoors, excellent flexibility, tenacious adhesion, and good electrical insulating qualities.

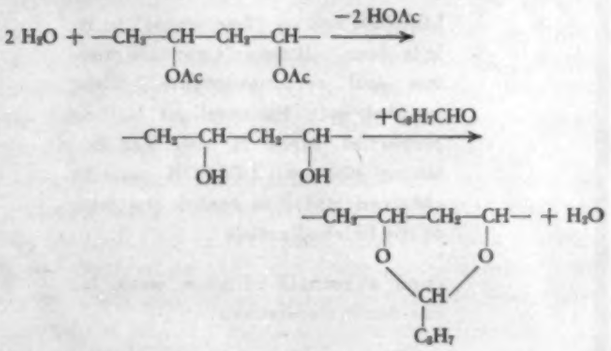
4. *Vinyl Resins.* Practically all of the commercial resins formed by strictly addition reactions are based on the polymerization of ethylene groups. The simplest members of this class are the polyesters of vinyl alcohol, characterized by the presence of the unsaturated radical $CH_2{=}CH{-}$. The chloride and acetate esters are the compounds generally employed in the preparation of these vinyl resins. They are synthesized by the action of the respective acids on acetylene or by the dehydration or dehydrohalogenation of saturated derivatives of ethylene. The esters polymerize readily under the influence of heat, light, or catalysts to form thermoplastic resins. The usual conception of the structure of such resins is that they exist as chains of various lengths formed from the original monomers.

One of the more widely used of the vinyl resins is the copolymer produced in a reaction mixture of vinyl chloride and vinyl acetate. The molecular chain produced in this instance contains irregularly distributed chloride and acetyl groups built up from both monomers as follows:

The resin produced in this manner is in many respects superior to a mixture of the chloride and acetate resins produced separately and blended. One such copolymer now on the market has a vinyl chloride-vinyl acetate ratio of 87 to 13.

The vinyl resins are odorless, tasteless, and resistant to moisture, dilute acids and alkalies. They are frequently employed as chemical-resistant coatings for cans, concrete and stucco walls, and paper liners for container tops. Other important applications include the fields of adhesives, impregnating agents, and moldings.

Another type of the vinyl resins which has recently become of special industrial interest is the vinyl acetal group. These resins are made by the hydrolysis of vinyl acetate resins to produce hydroxyl groups in the molecule which are then combined with aldehydes in acetal linkages. The reaction with butyraldehyde may be represented as follows:



This vinyl resin is particularly adapted to serving as the plastic in laminated glass, being characterized by transparency, flexibility, toughness, good adhesion, and unusual resistance to impact at low temperatures.

5. *Acrylate Resins.* Among the latest additions to the commercially available synthetic resins are the

polymers of the esters of acrylic acid, $CH_2{=}CH{-}COOH$, and methacrylic acid, $CH_2{=}C(CH_3){-}COOH$. The reactions involved in the synthesis of acrylic acid esters, starting with ethylene chlorohydrin, may be represented as follows:

(1) $CH_2OH.CH_2Cl + NaCN \longrightarrow CH_2OH.CH_2CN + NaCl$

(2) $CH_2OH.CH_2CN + ROH + H_2SO_4 \longrightarrow CH_2{=}CH{-}COOR + NH_4HSO_4$

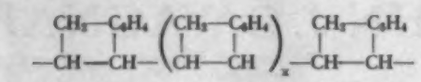
Esters of methacrylic acid are conveniently prepared by converting acetone cyanohydrin into alpha-hydroxyisobutyric acid esters and dehydrating the hydroxy ester. The esters of both acrylic and methacrylic acids polymerize under the influence of heat, light, oxygen, and oxygen-yielding substances, for example, sodium peroxide, hydrogen peroxide, and benzoyl peroxide. The mechanism of the polymerization of polyacrylates is believed to be similar to that of other compounds containing vinyl groups.

The polymers of the acrylates and methacrylates are characterized by colorless transparency, adhesive qualities, elasticity, and stability to light, moderate heat, and weathering. They are available as relatively hard cast sheets, as molding powders, and as granular solids readily soluble in many organic solvents. Their principal uses at present, such as the intermediate plastic layer in laminated glass and as a non-hazardous substitute for glass in goggles and airplane windshields, take advantage of the remarkable optical clarity of these resins. They are also finding applications as protective coatings, finishes for leathers, impregnating agents for textiles, and as dentures and adhesives.

6. *Styrene Resin.* A resin of particular interest in the electrical field because of its excellent insulating qualities and negligible water absorption is polystyrene. Formerly styrene resin was produced by the direct action of heat on ethylbenzene with or without the addition of chlorine. A better grade of resin is now produced by the isolation and subsequent polymerization of the monomeric styrene, $C_6H_5{-}CH{=}CH_2$, which has been placed in production in this country during the past year or two. Styrene is conveniently prepared by passing ethyl chloride through benzene to form ethylbenzene, which is then chlorinated and the chlorinated hydrocarbon dehydrohalogenated. A chain structure similar to that of other vinyl polymers is generally attributed to styrene resin.

Styrene plastics are employed chiefly for insulating parts in high-frequency service, especially in radio applications where minimum dielectrical losses are essential. Their resistance to moderately strong acids and alkalies and their ready adaptability to molding by injection will probably result in the extension of their applications to many other fields.

7. *Indene Resins.* The indene resins are prepared from indene, cumaron, and their homologs which are obtained from coal-tar distillate. The solvent naphthas containing these substances are treated with a polymerizing agent, such as sulfuric acid. The mechanism of the polymerization is considered to be essentially like that of the ethylene group in vinyl compounds. Polyindene is thought to have the general formula



where x is about 60. Polycumaron is similar to polyindene except that oxygen replaces the methylene group. The industrial product is primarily a mixed polymer of the two monomers. The best grades of these resins are light in color and free of acidity but are brittle. They are used chiefly in varnishes, as rubber softeners, and as an ingredient in molding compositions.

Note: This article introduces Dr. Kline's detailed survey and classification of organic plastics. Additional installments will appear in July and August issues of Modern Plastics.—Editor

METHYLOLTHIOUREAS

(*Continued from page 45*) (40 per cent) were slowly added to the solution which was subsequently warmed up to 40 deg. C. with constant stirring. The formaldehyde solution had a slightly acid reaction (0.07 percent of formic acid). The solution was kept at 40–45 deg. C. for 45 minutes, then distilled in vacuo, taking care to avoid any raise of temperature over 50 deg. C., until no more water distilled over. The viscous liquor was allowed to crystallize. The crystallization is rather slow and will take place only after standing in a refrigerator several hours and after frequent rubbing with a glass rod. The crystals resemble small needles. This product may be recrystallized from an equal weight of water, taking care not to heat it above 50 deg. C. The recrystallized product gave the melting points 97–98 deg. C. (not corr.). An elementary analysis gave the following results:

Calculated for methylolthiourea $C_2H_6N_2OS$	Found:
S = 30.19%	S = 30.04%, 30.10%
N = 26.41%	N = 25.82%

The substance is easily soluble in water, alcohol, ketones, hexanol, ethyl acetate, etc.; practically insoluble in hydrocarbons and ethyl ether. Treatment of its aqueous solution with a neutral solution of silver nitrate yields a light brown color which becomes deeper on standing and finally produces a precipitate of silver sulphide. When heated for some time in a dry state on the water bath the methylolthiourea was transformed into a resinous soft mass which was partly insoluble in water. Quite a similar product was formed when heating the substance with 10 percent acetic acid on the water bath.

The formation of a methylolthiourea by means of a stronger acid solution was also attempted. To 12.67 g. of thiourea in 100 ml. of water were added 12.5 ml. of formaldehyde solution containing one ml. of hydrochloric acid of 10 percent strength and the solution heated as in the previous experiment at 40–45 deg. C. The solution had a resinous character after concentration in vacuo. The crystals which were finally obtained after 4 days decomposed at 207 deg. C. and proved to be nearly insoluble in water. It is therefore evident that the presence of strong acids is detrimental to the formation of methylolthiourea.

2. *Monomethylolthiourea from thiourea and formaldehyde in alkaline solution:* 15.2 g. of thiourea were dissolved in 112 ml. of water and a mixture of 15 ml. of formaldehyde and 1.2 g. calcined magnesia added in small portions at 35–40 deg. C. The solution remained weakly alkaline during the reaction. After 15 minutes at 35–40 deg. C., it was cooled, filtered and distilled in vacuo at low temperature. The residue gradually stiffened when cooled and crystallized overnight in the form of hard crusts. Some of the crystals had a structure resembling common salt. It then was pressed to free it from the mother liquor, redissolved in about an equal amount of water, neutralized with 1/10 normal sulphuric acid

and allowed to crystallize again. After redissolving once more, concentrating in vacuo and crystallizing in the cold, the product showed a melting point of 92–94 deg. and gave the following results on analysis:

Calculated for methylolthiourea	Found:
S = 30.19%	S = 29.93%, 30.02%
N = 26.41%	N = 26.00%

This product reacts very slowly with a neutral solution of silver nitrate. It took about 24 hours for a precipitate of silver sulphide to be seen. The characteristics mentioned previously for methylolthiourea under "1," applied also to this product.

3. *Conversion of monomethylolthiourea from "1" into its isomer by sodium hydroxide:* The monomethylolthiourea described under "1" was treated with 1/10 normal sodium hydroxide. It was thereby transformed into another crystalline product which had about the same percentage composition. To that effect 2 g. of the methylolthiourea were dissolved in 2.5 ml. of the sodium hydroxide solution at 40 deg. C. From this solution there separated in a desiccator over sulphuric acid crystals resembling pin tops which after several recrystallizations fused at 80–83 deg. C. (uncorr.) and gave on analysis these figures:

Calculated for methylolthiourea	Found:
S = 30.19%	S = 29.67%, 29.77%
N = 26.41%	N = 26.60%

The perfect indifference of this product to neutral silver nitrate, the completely changed appearance and the difference in the melting points indicate that this product is not identical with the two methylolthioureas described above.

4. *Dimethylolthiourea from thiourea and formaldehyde in acid solution:* 15.2 g. of thiourea were dissolved in 30 ml. of formaldehyde at 40–50 deg. C. The solution was kept 15 minutes at this same temperature, the water distilled off in vacuo, and the residue put in the refrigerator to crystallize. After recrystallizing from a small amount of water, the product, which consisted of long needles, resembling spears, fused at 86–88 deg. C. The analysis gave the following results:

Calculated for dimethylolthiourea, $C_3H_8N_2O_2S$	Found:
S = 23.53%	S = 23.42%, 23.37%
N = 20.58%	N = 20.18%

This product had very similar solubilities to the monomethylol products. On heating the aqueous solution in the presence of a few drops of acetic acid on the water bath, there was formed a transparent, water-insoluble, hard resin which was insoluble in organic solvents. During this reaction a faint smell of formaldehyde was noted and several non-resinous, insoluble flocks floated in the solution. This dimethylolthiourea gave a precipitate of silver sulphide with a neutral solution of silver nitrate.

Treated with a few drops of hydrochloric acid, the dimethylol product gave a crystalline precipitate which was much less soluble in water and decomposed at 195–196 deg. C. When continuing the reaction for a longer time the solution gelled and had a resinous character. But this resin, when warmed up, became quite soft, although it was insoluble in water.

5. *Dimethylolthiourea from thiourea and formaldehyde in alkaline solution:* 15.2 g. of thiourea were added to a solution of 0.2 g. of hexamethylenetetramine in 30 ml. of formaldehyde at 30–35 deg. C. which temperature was maintained throughout the reaction. As soon as a clear solution was obtained, evaporation in vacuo followed and crystallization of the residue in the refrigerator. After careful recrystallization a substance was obtained consisting of small needles with a melting point of 83–85 deg. C. This product showed only a faint reaction with a neutral solution of silver nitrate. The analysis gave figures which were in agreement with those of a dimethylolthiourea. When heated on the water bath in the presence of a little acetic acid, this product, too, became transformed into an insoluble resin, but slight differences in the reaction could be observed. The resin which was formed had a more brittle character and a much less smooth and even surface than the one described above. The reactions and solubilities of the dimethylolthioureas from alkaline solution were for the rest quite similar to those described under "4."

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